NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

DEPARTMENT OF DEFENSE QUALITY MANAGEMENT SYSTEMS AND ISO 9000:2000

by

Tommie J. Lucius

March 2002

Thesis Advisor:	Michael Boudreau
Associate Advisor:	Ira Lewis

Approved for public release; distribution unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** March 2002	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE: Department of Defense Quality Management Systems and ISO 9000:2000			**5. FUNDING NUMBERS**
6. AUTHOR(S) Tommie J. Lucius			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			**12b. DISTRIBUTION CODE**

13. ABSTRACT (maximum 200 words)

The purpose of the research is to examine and evaluate the emergence of the International Organization for Standardization, commonly referred to as ISO, quality standard for the year 2000 as it applies (past and present) to the Department of Defense (DoD) quality management system (QMS) in procurement. In particular, the researcher will examine the new standard and its utility for DoD procurement, focusing on changes from the previous ISO 9000 series. Leading defense industry quality managers and Defense Contract Management Agency Quality Assurance Managers will provide insight to the thesis. In order to understand the present and future of DoD Quality Assurance and Management, the thesis will briefly look at past quality assurance policy from DoD and the ISO. Likewise, this research will explore issues and concerns that contracting officers and program managers in Government will now need to become familiar with as they execute ISO 9000:2000. The effort will emphasize how ISO 9000:2000 fits within the realm of DoD procurement and what organizations need to do in order to achieve excellent products in a total quality management environment.

14. SUBJECT TERMS ISO 9000, Quality Management Systems			**15. NUMBER OF PAGES** 151
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UL

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution unlimited

DEPARTMENT OF DEFENSE QUALITY MANAGEMENT SYSTEMS AND ISO 9000:2000

Tommie J. Lucius
Captain, United States Army
B.S., Arkansas State University, 1993

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
March 2002

Author: Tommie J. Lucius

Approved by: Michael Boudreau
Thesis Advisor

Ira Lewis
Associate Advisor

Douglas A. Brook, Ph.D.
Dean, Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

The purpose of the research is to examine and evaluate the emergence of the International Organization for Standardization, commonly referred to as ISO, quality standard for the year 2000 as it applies (past and present) to the Department of Defense (DoD) quality management system (QMS) in procurement. In particular, the researcher will examine the new standard and its utility for DoD procurement, focusing on changes from the previous ISO 9000 series. Leading defense industry quality managers and Defense Contract Management Agency Quality Assurance Managers will provide insight to the thesis. In order to understand the present and future of DoD Quality Assurance and Management, the thesis will briefly look at past quality assurance policy from DoD and the ISO. Likewise, this research will explore issues and concerns that contracting officers and program managers in Government will now need to become familiar with as they execute ISO 9000:2000. The effort will emphasize how ISO 9000:2000 fits within the realm of DoD procurement and what organizations need to do in order to achieve excellent products in a total quality management environment.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

The author would like to acknowledge the assistance provided by Defense Contract Management Agency, Headquarters, Boston, MA.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. BACKGROUND

This research will examine and evaluate the emergence of the International Organization for Standardization, commonly referred to as ISO, quality standard for the year 2000 as it applies (past and present) to the Department of Defense (DoD) quality management system (QMS) in procurement. In particular, the researcher will examine the new standard and its utility for DoD procurement, focusing on changes from the previous ISO 9000 series. Leading defense industry quality managers and Defense Contract Management Agency Quality Assurance Managers will provide insight to the thesis. In order to understand the present and future of DoD Quality Assurance and Management, the thesis will briefly look at past quality assurance policy from DoD and the ISO. Likewise, this research will explore issues and concerns that contracting officers and program managers in Government will now need to become familiar with as they execute ISO 9000:2000. The effort will emphasize how ISO 9000:2000 fits within the realm of DoD procurement and what organizations need to do in order achieve excellent products in a total quality management environment.

The past decade has brought marked change in the way DoD conducts acquisition. A culture versed in military specifications, regulations, and standards now turns its focus toward better understanding the global marketplace and adapting the "new" economy culture to DoD procurement. One such change is in DoD management of quality. MIL-Q-STD 9858, once the standard by which all DoD contractors' quality assurance programs were measured, is now the least preferred by DoD.

The February 14, 1994, memorandum "Use of Commercial Standards in DoD" from then Under Secretary of Defense (USD) John M. Deutch opened and encouraged DoD acquisition and contracting professionals to "use commercial standards" to their maximum extent in all applicable acquisition matters. One memorandum began the change of converting the DoD acquisition culture of specifications in design and quality standards to specifications of performance and best commercial practices. Federal Acquisition culture continues to evolve just as the ISO 9000 QMS. Departure from MIL-

Q-9858 represents a significant change for the DoD Acquisition workforce. Subsequent memorandums by Secretaries of Defense Perry and Cohen, as well as the Under Secretary of Defense (USD) Acquisition Technology and Logistics (AT&L) Jacques Gansler, championed the adoption of commercial practices. A part of this change was the move from MIL-Q-9858, Quality Assurance, and other DoD quality assurance guidance to commercial standards like ANSI 9000 and the ISO 9000 Series of Quality Assurance guidelines. These changes define and mark the Single Process Initiative introduced by the Office of the Secretary of Defense in 1995 (23).

The move to commercial quality management standards (QMS) has not brought a watershed of high quality procurements. Many of the same weaknesses that existed under MIL-Q-9858 remain. Registered ISO 9000 organizations can and do produce nonconforming products. Inadequate quality assurance programs exist under ISO. DCMA's role remains, as it was prior to the Single Process Initiative and subsequent acceptance of commercially acceptable quality management systems, to provide quality audit, oversight, and surveillance. Discouraging MIL-Q-9858 has not yielded the efficiencies and effectiveness once thought possible under non-military standards. ISO 9000 is not the panacea of QMS for the DoD or the civilian sector. One reason is DoD procurement is not an exact replica of civilian sector procurement. DoD has numerous stakeholders, often unable to develop a requirements consensus. DoD use of public funds associated with congressional representation and constituents do not reflect the bottom-line philosophy of corporate America. High risk is associated with weapon systems to greater degree than with private system or product development. These are a few of the factors bearing on difficulties with QMS application in DoD.

The dynamic environment of business and information management continues to change industry and DoD practices. On December 15, 2000, ISO revised their quality standard eliminating the five previous standards and replacing them with two. The ISO standard is followed by much of the industrialized world and in many aspects codifies international quality management practices among industrialized countries. While ISO 9000 is a better QMS in many ways and has proven its worthiness over MIL-Q-9858, the acquisition environment is increasingly complicated and complex.

Firestone, a supplier of Ford for tires, represents a recent example of ISO 9000:1994 weaknesses where correlations can be drawn between the DoD and the commercial sector. Firestone, a QS 9000 registered corporation, provided non-conforming tires for the Ford Explorer. The non-conforming tires are linked to numerous accidents of the Explorer. The link resulted in Explorer occupant injury and a lack of public trust in Ford and Firestone products. The example brings attention to one of the reasons for the new ISO 9000 standard. The ISO recognized, as did many of its members, ISO 9000 must change and adapt to some its weaknesses. One major company observed that documenting one's processes and ensuring that the documented processes are followed, as required by the ISO standard, could result in an ISO-certified company producing excellent but useless concrete lifejackets (35). That particular company went on to develop its own quality system that placed emphasis on continuous process improvement and customer satisfaction, areas in which many felt the ISO standard was lacking (35).

Has ISO 9000:2000 addressed the weaknesses of the previous ISO 9000:1994 version in the dynamic environment of weapon systems acquisition? How effective is DoD, specifically DCMA, in properly evaluating companies using ISO 9000, and how can they become more effective under the new ISO 9000:2000 version? In what ways has and will DoD benefit from the ISO QMS, or not benefit? In short, what are ISO 9000:2000 effects, implications, and results?

Modern quality management systems are proactive. The idea is to design quality and build quality into the product instead of reacting or inspecting it in, the previous DoD quality assurance focus (30). No single aspect in the execution of services or manufacturing is more important than that of the quality of the service or item manufactured. The marketplace and DoD rely on the quality of products and services received. DoD quality managers, those responsible for quality management, and those who are beneficiaries of quality hold great responsibility to the public trust, especially in the procurement of weapon systems, due to weapon system cost, and more importantly, to the security of our nation and the safety of our military members. DoD knowledge and experience in the area of quality management systems (QMS) protects that public trust. If the reliance is broken, the public's trust in the product or service is broken. The services

provider or manufacturer's quality systems are subject to question when the public trust is broken. The object of this research is to explore the issues I have outlined.

B. OBJECTIVE AND RESEARCH QUESTIONS

The scope will include: (1) a review of commercial and Federal quality management practices, (2) an in-depth review of ISO 9000 and DoD quality management systems, (3) a survey and evaluation of commercial and DoD quality management systems focusing on ISO 9000, and (4) a study of current DoD quality assurance practices. The thesis will conclude with recommendations for implementing the new ISO 9000:2000 into Defense Contract Management Agency (DCMA) audits and program office evaluation of contractors.

The primary research question is what implications and effects will ISO 9000:2000 Quality Management System have on the DoD acquisition community? Subsidiary research questions include:

- What is ISO 9000?
- What is the Government's requirement for a quality management system and how has it affected the DoD and defense contractors?
- How does ISO 9000:1994 fit the Government's quality requirements and will ISO 9000:2000 be a better fit?
- What are the key conclusions and recommendations that might be drawn regarding the ability relationship ISO 9000:1994 and ISO 9000:2000 to meet the Government's quality requirements?

C. METHODOLOGY

The methodology used in this research will consist of the following steps.

- Conduct a literature search of books, magazine articles, CD-ROM systems, Internet, library, and other resources
- Conduct a review of commercial and Federal quality standards through a review of past and present quality practices
- Conduct a thorough review of ISO 9000 and DoD quality management systems
- Examine the current capabilities and limitations of DoD and ISO 9000 quality standards
- Compare and contrast TQM, ISO 9000, and DoD quality management systems addressing the advantages and disadvantages of each

- Evaluate the benefits and cost of ISO 9000 certification, both the 1994 and 2000 versions
- Question both commercial and DoD practitioners of quality management systems
- Identify essential elements of DoD and commercial practices in quality management and how best they can be applied under DCMA, and program offices
- Identify areas of weakness and potential changes to DoD quality management guidance in comparison
- Prepare and conduct analysis of ISO 9000, commercial, and Federal procurement quality management regulation and guidance
- Recommend changes to current DoD practices in quality management audit, evaluation and surveillance.

D. ORGANIZATION OF THE STUDY

The appendices include a comprehensive glossary of abbreviations and acronyms, a comparison to ISO 9000 versions 2000 and 1994 and MIL-Q-STD 9858, and the current DCMA Quality Assurance Checklist.

The research effort is organized into five chapters and eight appendices. Chapter I presents the thesis, outlining the objective, methodology, and organization of the research effort. Chapter II highlights ISO 9000:1994 and 2000 background, history, and standards. Chapter III presents and discusses the DoD quality management system requirements. Chapter IV provides perspective of quality assurance managers from Government and DoD contactors and analysis of the implications and effects of ISO 9000:1994 and 2000. I close with recommendations and conclusions in Chapter V.

THIS PAGE INTENTIONALLY LEFT BLANK

II. ISO 9000

A. INTRODUCTION

We will begin the research paper by providing some background on quality management systems. The background will briefly cover some key guidelines and systems based on performance and commercial standards from the old MIL-Q-9858 and Government defined standards, and provide an overview of the ISO: 9000 series quality standards that DoD has used as a framework for evaluating its own suppliers for the past seven years. The paper will then follow with an analysis and discussion of the salient and pertinent matters from the issues above. The main effort of the research paper is to focus on DoD management of quality systems and their relationship with ISO 9000.

A quote by Mark Schaeffer, Deputy Director, Systems Engineering, (DTSE&E/DDSE) sets the tone and framework for the thesis.

> Quality is not just another interesting subject, nor is this just another conference. Quality is one of those overarching [sic] considerations that we all believe in—we all strive for—but that too few seem to really understand (48).

Quality is not a new concept discovered in the last century. Consumers have understood the essence of quality since goods and services were bought and sold from earliest times. Quality is most simply defined and recognized by the user, but as there are many definitions of quality, there are many stakeholders in the effort of quality assurance and management. Joseph Juran defines the meaning of quality in two areas of critical importance (28).

> Quality means those features of products, which meet customer needs and thereby provide customer satisfaction. In this sense, the meaning of quality is oriented to income. The purpose of such quality is to provide greater customer satisfaction and, one hopes, to increase income. However, providing more and/or better quality features usually requires an investment and hence usually involves increases in costs. Higher quality, in this sense, usually "costs more."
>
> Quality means freedom from deficiencies – freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, and customer claims, and so on. In this sense, the

meaning of quality is oriented to costs, and higher quality usually "costs less." (28)

Quality, like beauty, has varied definitions and is subject to the perspective of the beholder. Simply put quality refers "to all the features of a product (or service) which are required by the customer." Quality management is defined as what the organization does to ensure that its products conform to the customer's requirements (7). Quality management and assurance are explored in this thesis, focusing on Juran's second definition of quality. DoD has traditionally oriented procurement towards cost.

Quality today is prevention-oriented and process-driven. This shifts the total responsibility for quality from the quality professionals to everyone in the organization. No longer a "stovepipe" discipline, quality must be an integral element of engineering, manufacturing, and coding of a product. Quality must be integral to the way we (DoD) do business. (50)

B. HISTORY

The US Military has had a strong influence on international quality standards. The Department of Defense began developing quality standards in the mid-1950s using techniques and procedures used during the industrial build up during World War II (36).

The military played an early role in quality standards. As early as 1450 B.C. the Egyptians used a form of measurements and inspection for swords. In the Middle Ages craftsmen both manufactured and inspected their work. Poor craftsmanship led to no business. Industrialization separated the craftsmen from manufacture and inspection. Honoré Le Blanc developed a pattern for musket manufacture for the French. Manufacture and quality inspection were separate (15). The eighteenth century created continued specialization.

In 1798, Thomas Jefferson introduced one of the earliest uses of U.S. military contracting and quality assurance when the newly formed nation contracted with Eli Whitney to manufacture 10,000 muskets. The muskets' construction called for interchangeable parts. Due to problems associated with the new technology of mass produced weapons (special machining, training and inspection) and the Government's discovery of frequent poor quality, it took Eli Whitney nearly ten years to deliver the

10,000 muskets originally contract for delivery in two years. Industrialization continued to separate quality responsibility from the hands of the producer during the early years of the U.S. (15,35)

During the years of the then War and Navy Departments and prior to World War Two, Government inspectors practiced 100 percent inspection of manufactured goods and material. The early view concerning quality was that it was the War Department's responsibility and duty to assure and validate the quality of the goods and services provided to the services. Assurance was gained through the imposition of rigid standards, exacting specifications, and the Government performing inspections throughout the production process. (33)

The twentieth century ushered new thought on quality assurance. Early pioneers of quality control like Walter Shewhart, Howard Dodge, George Edwards, and W. Edwards Deming expanded thought and technology in quality discipline. Shewhart led his team of Bell Labs quality pioneers in the development and use of Statistical Quality Control (SQC). SQC went beyond mere inspection and the focus created a method to identify problems in the process of manufacturing and production (15). World War II marked a shift to sampling methods as a means of ensuring quality. Due to the large amounts of material being procured for the war effort it became impractical and costly for the War and Navy Departments to continue reliance on 100% inspection to assure quality.

The Government found that it could achieve a high degree of confidence in product quality by using sampling methods. Statistical sampling plans and methods were developed and used as additional methods to assure quality while reducing Government reliance on 100% inspection methods. (33,35) This era began the U.S. military use of stringent standards on its suppliers. The War Production Board offered training in the new quality control process, much like the Defense Acquisition University offers courses today (15). Dr. Deming himself was one of the lecturers. The aim was to train people how to maintain the quality of delivered product while substantially reducing the inspection time. This also meant a substantial reduction in the number of Government inspectors. As a result, the Army introduced sampling inspection procedures in 1942 to

ensure and maintain quality without 100% inspection. By 1945, several similar plans were available across the Services. During the 1950s, the DoD published three military standards for inspection sampling, and in 1963 one of these documents became an ABCA (America, Britain, Canada, and Australia) Standard. (50)

During the early 1950s, as weapon systems continued to increase in complexity, the Air Force pioneered requirements for a contractor quality program. These requirements were aimed at major contractors engaged in the development, production, and selected service tasks for aircraft and missile systems. Following the Air Force example, the other Services initiated similar requirements for their products of similar complexity. The OSD staff brought all parties together in the late 1950s to establish a coordinated approach on quality. These organizations developed and issued Military Specification MIL-Q-9858, Quality Program Requirements. (50)

These standards are what we currently call Military Quality Standards (MIL-Q-STD) (15). In the late 1950's the DoD developed the MIL-Q-9858 standard (titled "Quality Program Requirements"), which subsequently was used as the model for British Standard BS-5750, released in 1979 (15,33). In the early 1960's, the DoD developed a second standard, the MIL-I-45208 (titled "Inspection System Requirements").

One of the models for the ISO 9000 series of internationally accepted quality standards model was BS-5750. A great degree of commonality exists between DoD MIL-Q 9858 and the ISO 9000 series (15). The reader may review Appendix B (ISO to MIL-Q Cross Reference) for a comparison of MIL-Q 9858, ISO 9000:1994, and ISO 9000:2000.

MIL-STDs, however, were not influencing the vast majority of commercial manufacturing in the post-war era. Expanded commercial production called for even greater standardization and consumer need for higher levels of quality. The Japanese using, ironically, Henry Ford's book, *My Life and Work*, and heavily influenced by Deming developed the methods of total quality management (TQM) shifting quality responsibility back to the worker. The U.S. began employing TQM philosophy in the early 80s (15,50). During this time in the late 1980's - early 1990's DoD shifted to a "management systems" approach to ensure quality.

The International Organization for Standardization (ISO), founded in 1947, embarked to prepare international standards relating to quality assurance techniques and practices during the international shift in management philosophy. A technical committee was approved and worked under the title of Quality Assurance ISO/TC 176. The ISO created the world's first internationally accepted "generic quality management standards" and outlined in the ISO 9000 family of standards with the first editions published in 1987 (47).

When ISO/TC 176 embarked on the development of generic quality management standards for worldwide application, it was able to take advantage of a substantial base of national experience, notably in the United Kingdom and in Canada. In the United Kingdom, the BS 5750 standards were well on their way to broad acceptance and, in Canada, a series of national standards known as CAN-Z299 were also widely used. Other countries with well-developed quality management practices, such as Japan, also took a keen interest in the work of the new committee. In addition, experience of military quality assurance specifications, such as the NATO AQAP series (see Appendix C (NATO AQAP)), enriched the sources from which TC 176 was able to draw. (7)

The ISO 9000 series of International Quality Standards are an outgrowth of efforts by the European Committee for Standardization and the ISO. The formation of the European Union in 1992 provided the major thrust in harmonizing the nineteen different European country standards into one. The ISO 9000 series standards were released by the International Organization for Standardization in 1987 and were updated in 1994. ISO released its newest version in late 2000. The International group adopted the name ISO for the standards, from the Greek word "iso" which means "equal" (1,35). (The reader will see the use of ISO to be interchangeable with International Organization for Standardization (ISO) as it is used in this paper.) During the latter part of the 1980s, DoD and many defense contractors discussed the possibility of using the new ISO 9000-ANSI/ASQC 90 series of quality standards instead of military specifications. However, DoD did not see any significant benefit in changing to the 1987 version of the ISO 9000 series.

During this period in the early 90's, a shift occurred in the methods DoD used for procurement. Numerous examples of Executive Branch and DoD policy and guidance document the base of our current Government and DoD procurement policy. A partial list and a brief synopsis of these examples are provided in Appendix E (Executive and DoD Policy Guidance).

C. UNDERSTANDING THE ISO QUALITY SYSTEM

1. ISO Basics

ISO 9000 is actually a family of standards, referred to under a generic title for convenience. The family consists of standards and guidelines relating to management systems, and related supporting standards on terminology and specific tools, such as auditing (the process of checking that the management system conforms to the standard). ISO 9000 is primarily concerned with "quality management," meaning what the organization does to ensure that its products conform to the customer's requirements. ISO 9000 is also concerned with the way an organization goes about its work, and not directly the result of this work. (52,53).

Nevertheless, the way in which the organization manages its processes is obviously going to affect its final product. In the case of ISO 9000, it is going to affect whether or not everything has been done to ensure that the product meets the customer's requirements. However, ISO 9000 is not a product standard. The management system standards in these families state requirements for what the organization must do to manage processes influencing quality (ISO 9000). The philosophy is that these requirements are generic. No matter what the organization is or does, if it wants to establish a quality management system, then such a system has a number of essential features that are spelled out in ISO (3,52).

The ISO 9000 family of standards represents an international consensus on good management practices with the aim of ensuring that the organization can time and time again deliver the product or services that meet the client's quality requirements. These practices have been distilled into a set of standardized requirements for a quality management system, regardless of what the organization does, its size, or whether it's in the private, or public sector. Full-time standardization experts do not develop ISO

standards. The business sectors most interested in implementing the eventual standards are the ones who provide experts to develop the standards. (3,7)

The primary quality organizations representing U.S. interests are the following. The American National Standards Institute (ANSI) represents over 250 US organizations that write standards, and represent the U.S. in ISO. The American Society for Quality (ASQ), formerly ASQC, coordinates with ISO and directs ISO activities in the U.S. on behalf of ANSI. The Registrar Accreditation Board (RAB), an ASQ subsidiary corporation, accredits quality systems registrars in the USA. The RAB also performs initial evaluations of prospective registrars and issue certificates. (32,34)

2. Generic Management System Standards

ISO 9000 provides a standardized framework for taking a systematic approach to managing business processes (an organization's activities) so that they consistently turn out product conforming to the customer's expectations. ISO 9000 lays down what requirements a quality system must meet, but does not dictate how they should be met in an organization – which leaves great scope and flexibility for implementation in different business sectors and business cultures...as well as different national cultures (52). This flexibility allows for organizations to develop their own unique ways to implement ISO standards.

The vast majority of ISO standards are highly specific to a particular product, material, or process. However, both ISO 9000 and ISO 14000 are known as “generic management system standards.” Generic means that the same standards can be applied to any organization, large or small, whatever its product – including whether its "product" is actually a service – in any sector of activity, and whether it is a business enterprise, a public administration, or a Government department (7,52). Management system refers to what the organization does to manage its processes, or activities. To be really efficient and effective, the organization can manage its way of doing things by systemizing it. This ensures that nothing important is left out and that everyone is clear about who is responsible for doing what, when, how, why and where (15).

The organization should carry out auditing of its ISO 9000-based quality system itself to verify that it is managing its processes effectively – or, to put it another way, to

check that it is fully in control of its activities. This is a self-audit. A second party audit is one where an organization invites its clients to audit the quality system in order to give them confidence that the organization is capable of delivering products or services that will meet their requirements. DCMA's audits and surveillance are second party audits. Organizations may engage the services of an independent quality system certification body to obtain an ISO 9000 certificate of conformity. This last option has proved extremely popular in the market place because of the perceived credibility of an independent assessment. It may thus avoid multiple audits by the organization's clients, or reduce the frequency or duration of client audits. The certificate can also serve as a business reference between the organization and potential clients, especially when supplier and client are new to each other, or far removed geographically, as in an export context. (6,52)

3. Certification, Registration and Accreditation

Certification, registration and accreditation are often misunderstood and misleading and are directly related to misconceptions of the ISO quality management system and what it can or cannot provide to an organization and its customers towards achieving a quality product or service. In many individual's minds, there is a linkage between the organization "ISO" and the concept of quality system certification and registration.

The assessment of a quality system against the requirements of one of the ISO 9000 standards and the subsequent issuance of a certificate to confirm that it is in conformance with the standard's requirements is variously referred to in different countries as certification or registration. Likewise, the bodies that issue ISO 9000 certificates – "certification bodies" – are referred to in some countries as "registration bodies" or "registrars." In the United States, "registrars" is the commonly used term. Again, these different appellations refer to the same type of body (7).

A final point on terminology concerns "ISO 9000 certification." In fact, "ISO 9000 certification" means certification against ISO 9001, ISO 9002 or ISO 9003 (1994 version) or ISO 9001 and 9004 (2000 version). The generic term "ISO 9000 certification" is much more convenient than alternatives such as "ISO 9001/2/3" or "ISO 900x" certification. This is why ISO 9000 certification has entered into common usage,

and is employed in this thesis as in other literary products and common language. However, only an actual "ISO 9000 certificate" will specify the standard against which the quality system in question has been assessed and found to be in conformance. (11,52)

ISO itself does not carry out assessments to check that users are in conformity with the requirements of the standards. Conformity assessment – as this process is known – is a matter for suppliers and their clients in the private sector, and of regulatory bodies when ISO standards have been incorporated into public legislation (7). The concept of ISO 9000 certification and registration was developed by the private sector. These activities are conducted by independent commercial and private organizations, which have no direct affiliation with ISO. (32)

A point, which logically follows from the above remarks, is that it is false to describe a company as "ISO-certified," "ISO-registered," or to use phrases such as "ISO certification," "ISO certificates" and "ISO registration." ISO operates no system for assessing the conformance of organizations' management systems with standards in the ISO 9000 family. ISO itself does not carry out ISO 9000 audits and awards no certificates attesting to conformity with the standards. There is no such thing as "ISO certification," or "ISO registration," whether in relation to ISO 9000, ISO 14000, or any other ISO standard. ISO 9000 auditing and certification are carried out independently of ISO by certification bodies under their own responsibility. (7,11)

D. ISO 9000:1994

The ISO-9000:1994 series consists of five standards, along with some complementary standards, e.g., ISO-8402: 1994 Quality Management and Quality Assurance – Vocabulary (4).

The five standards are:

- ISO9000-1: Quality Management and Quality Assurance Standards - Part
- ISO9001: Quality Systems - Model for Quality Assurance in Design, Development, Production Installation and Servicing
- ISO9002: Quality Systems - Model for Quality Assurance in Production, Installation and Servicing
- ISO9003: Quality Systems - Models for Quality Assurance in Final Inspection and Test

- ISO9004: 1994 Quality Management and Quality System Elements - Part 1: Guidelines

The ANSI/ASQC documents covered under ANSI/ASQC Q-9000 represent different levels of quality requirements outlined as follows: (4,8)

- **ANSI/ASQC-Q9001** "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing"
- **ANSI/ASQC-Q9002** "Quality Systems - Model for Quality Assurance in Production and Installation"
- **ANSI/ASQC-Q9003** "Quality Systems - Model for Quality Assurance in Final Inspection and Test"
- **ANSI/ASQC Q-9001, Q-9002 and Q-9003** are the U.S. equivalents and equal to the international quality standards ISO 9001, ISO 9002, and ISO 9003, respectively

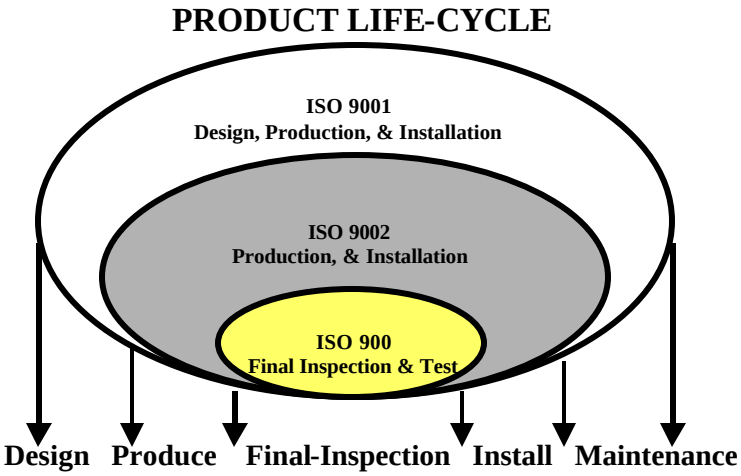


Figure 1. ISO Spheres of Influence, [After Ref. 35].

ISO 9001 is the most far-reaching standard of all three Quality System Models 9001, 9002 and 9003, see Figure 1 (35). ISO 9001 covers a contractor's quality program throughout its entire lifecycle, from design, through production, installation and maintenance. Of the three ISO 9000 documents, ISO 9001 is the most reflective of MIL-Q-9858 (41). ISO 9002 addresses production, final inspection and test, and installation. ISO 9003 covers only final inspection and test. The following excerpts from ISO-9001 will familiarize the reader with its twenty elements. In many cases, information from one

element affects the other elements. In this way, each element influences the others. In the ISO 9000 series documents (and in many quality systems based on this standard), the word "supplier" refers to the company following the quality standard. ISO purports managing suppliers over managing supplies. (1)

ISO 9000 provides a framework for a quality system and contains twenty elements as depicted below: (4,35)

1 Management Responsibility	11 Control of Inspection, Measuring & Test Equipment
2 Quality System	12 Inspection & Test Status
3 Contract Review	13 Control of Nonconforming Product
4 Design Control	14 Corrective & Preventive Action
5 Document & Data Control	15 Handling, Storage, Packaging, Preservation & Delivery
6 Purchasing	16 Control of Quality Records
7 Customer Supplied Product	17 Internal Quality Audits
8 Product Identification & Trace ability	18 Training
9 Process Control	19 Servicing
10 Inspection & Testing	20 Statistical Techniques

Table 1. The 20 Elements of ISO 9000:1994, [After Refs. 4,35].

E. ISO 9000:2000

1. Catalyst for Change

The major reasons for the year 2000 revisions of the standards include:

- Emphasizing the need to monitor customer satisfaction
- Meeting the need for more user-friendly documents
- Assuring consistency between quality management system requirements and guidelines
- Promoting the use of generic quality management principles by organizations, and enhancement of their compatibility with ISO 14001
- Emphasis on continual improvement

Extensive surveys were performed by the ISO commission tasked with ISO revision, ISO/TC 176, on a worldwide basis to understand the needs of all users of the quality management system standards. The new revisions take into account previous experience with quality management system standards (1987 and 1994 editions) and emerging insights into generic management systems. ISO 9000:2000 purports a closer alignment of quality management systems with the needs of organizations and better

reflects the way organizations run their business activities. ISO's rules of procedure (the ISO/IEC Directives) also specify that standards be periodically revised to ensure that those standards are current and satisfy the needs of the global community. (14)

ISO 9001:2000 aims at guaranteeing the effectiveness (but not necessarily the efficiency) of the organization. For improved organizational efficiency, however, the best results can be obtained by using the new ISO 9004:2000 in addition to ISO 9001:2000. The guiding quality management principles of ISO 9004:2000 are intended to assist an organization in ISO 9001:2000 principles like continual improvement, which should lead to efficiency throughout the organization. (48)

Efficiency refers to the "capacity to produce results with minimum expenditure of time, money, or materials." Efficiency focuses on the input-output ratio. To be efficient is to do things well, to attend to the internal organization by refining, routinizing, formalizing, elaborating on existing knowledge, and making short-run improvements. Effectiveness, on the other hand, is defined as "productive results." The focus is on doing the right thing and an absolute level of input or outcome determines efficiency. Effectiveness and efficiency comes from an understanding and interpretation of the external environment as it signals what ongoing adaptations in goals, outputs, and outcomes are required. (49)

ISO established a 3 year "transition" period during which accredited certification to the 1994 standards and ISO 9001:2000 may continue to coexist. This "transition period" will end on 15 December 2003. By that date, all organizations wishing to retain accredited certification will have to bring their quality management system to compliance with ISO 9001:2000. (52)

2. ISO 2000 Family

The ISO 9000 family previously contained more than 20 standards and documents. This proliferation of standards was a particular concern of ISO 9000 users and customers. To respond to this concern, the ISO 9000:2000 family consists of four primary standards supported by a considerably reduced number of supporting documents (guidance standards, brochures, technical reports, and technical specifications) compared to previous editions. To the extent possible, the key points in the past documents were

integrated into the four primary standards, and sector needs addressed while maintaining the generic nature of the standards. The four primary standards are (25):

- ISO 9000: Quality management systems – Fundamentals and vocabulary
- ISO 9001: Quality management systems – Requirements
- ISO 9004: Quality management systems – Guidance for performance improvement
- ISO 19011: Guidelines on quality and/or environmental management systems auditing (*to be published*)

ISO 9001 and ISO 9004 create a “consistent pair” of quality standards. The primary aim of the "consistent pair" is to relate modern quality management to the actual processes and activities of an organization, including the promotion of continual improvement and enhancement of customer satisfaction. (48)

The quality management system described in the revised standard is based on quality management principles that include the "process approach" and "customer focus." ISO 9001:2000 and ISO 9004:2000, both, apply a process approach. The "20 element" structure of ISO 9001:1994 has been replaced by this process-based quality management system (PQM), which is shown schematically in Figure 2, below. (28, 48) For more information about the process management approach and how it is applied to ISO 9000:2000, review Appendix F (ISO Process Management Approach).

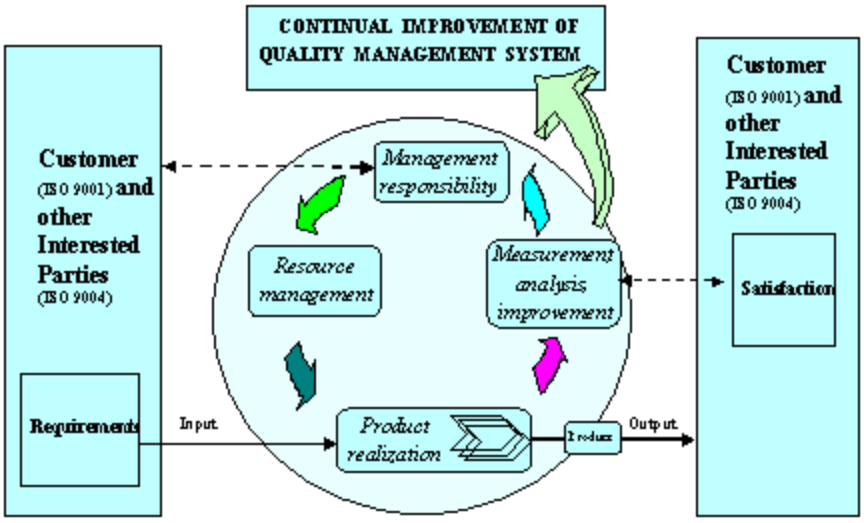


Figure 2. Model of a Process Based Quality Management System, [From Ref. 48].

ISO recommends the greatest value be obtained when the entire family of standards is used in an integrated manner. ISO 9001:2000 is the first level of performance. ISO 9004:2000 practices are implemented to make the quality management system increasingly effective in achieving business goals. ISO 9001:2000 and ISO 9004:2000 have been formatted as a consistent pair of standards to facilitate their use in combination (48). Although they are "stand alone" standards, they provide synergy when used together, increasing organizational efficiency and effectiveness (25). The reader may at this time review Appendix D (ISO Family), which provides details of the ISO 9000:2000 Family.

3. ISO 2000 Activities and Disciplines

ISO 9001:2000, like its 1994 predecessor, is used by organizations seeking to establish a management system that provides confidence in the conformance of their products to established or specified requirements. It is now the only standard in the ISO 9000 family against whose requirements a quality system can be registered to by an external agency (48).

There are five sections in the standard that specify activities, often referred to as the five disciplines of ISO 9000. Product realization describes the activities used to supply products; quality systems may exclude the parts of the product realization section that are not applicable to an organization's operations. The product realization section is the only area where exclusion is an option. The requirements of the other four sections are: quality management system, management responsibility, resource management and measurement, analysis and improvement. These four apply to all organizations. The five sections of ISO 9001:2000 define a consistent approach to provide product that meets customer requirements. ISO 9004:2000 is used to extend the benefits obtained from ISO 9001:2000 to all stakeholders (48). The ISO 90001 sections are organized into eight standard clauses. (26,27) They are:

- Section 1 – Scope
- Section 2 - Normative Reference
- Section 3 - Terms and Definitions
- Section 4 - Quality Management System
- Section 5 - Management Responsibility
- Section 6 - Resource Management
- Section 7 - Product Realization
- Section 8 - Measurement, Analysis, and Improvement

Of the eight clauses of the new standard, sections 4 through 8 are the most important to the QMS. These clauses actually comprise the "heart" of the quality management system. Each one of these five main clauses has a number of sub clauses which support the concept identified in the main clause. (32) The reader may find additional perspective on the structure of ISO 9000:2000 by reviewing Appendix G (ISO 9000:2000 Re-structure).

4. Quality Management Principles

Eight quality management principles provide the basis for the revised ISO 9000:2000. Senior management, as a framework to guide their organizations towards improved performance, can use these principles. The principles contained in the new ISO 9000 standards are more "aggressive" in nature than the previous version.

The changes to the ISO standard series require the user to be more proactive. The principles help to define and validate the quality of the work, goods, or services they

provide. The principles concentrate on customer focus, top-level management, involvement and continuous improvement. (26,32)

The list below provides the standardized descriptions of the principles as they appear in ISO 9000:2000 and ISO 9004:2000. ISO states that the goal and benefit of the eight quality management principles, that underlie the ISO 9000:2000 series, is to form a basis for performance improvement and organizational excellence beneficial to the organization's quality management system. (26,32)

- **Principle 1 -- Customer focus**

  Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

- **Principle 2 -- Leadership**

  Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

- **Principle 3 -- Involvement of people**

  People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

- **Principle 4 -- Process approach**

  A desired result is achieved more efficiently when activities and related resources are managed as a process.

- **Principle 5 -- System approach to management**

  Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.

- **Principle 6 -- Continual improvement**

  Continual improvement of the organization's overall performance should be a permanent objective of the organization.

- **Principle 7 -- Factual approach to decision making**

  Effective decisions are based on the analysis of data and information.

- **Principle 8 -- Mutually beneficial supplier relationships**

> An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

ISO states that the introduction of the quality management principles is to address the proliferation of the 20 elements of ISO 9000:1994 and to better align with contemporary philosophy and objectives of most quality award programs and best management practices (48).

THIS PAGE INTENTIONALLY LEFT BLANK

III. DOD QUALITY ASSURANCE AND MANAGEMENT POLICY

A. INTRODUCTION

DoD QMS Policy is covered in a series of Federal and Defense Department Regulations, Policy, Directives, and Guidance. The Federal Acquisition Regulation (FAR), the Defense Federal Acquisition Regulation Supplement (DFARS), and the Department of Defense Directive 5000.2-R (DODD 5000.2-R) encompass U.S. DoD policy on acquisition and associated quality requirements. One of the primary agencies charged with executing the policy on quality management and assurance is the Defense Contract Management Agency (DCMA). DCMA provides guidance through the use of the DCMA Onebook. DoD QMS policy and the current policy relationship to ISO 9000 is based on a series of Executive guidance documents published in the 1990s, which are summarized in Appendix E (Executive and DoD Policy Guidance).

The change in DoD policy from military specifications to commercially acceptable quality standards resulted from concerns from industry that standards like MIL-Q-9858 requiring significant documentation in areas such as quality policies and procedures test results and analysis, manufacturing problems and proposed corrective actions were an excessive and unnecessary burden on industry. Contractors and many DoD employees suggested that much of the documentation added little value to the manufacturing and thus would consume contractor resources that could otherwise be spent on activities that add value (16). Many contractors were also using dual QMS: MIL-Q-9858 and a commercial QMS such as ISO 9000.

DoD recognition of ISO 9000 pleased industry but concerns of DoD quality assurance auditors continuing to use MIL-Q-9858 were high. Industry desire for a new "higher level quality standard" policy addressing the shift in DoD procurement quality assurance began to arise. DoD addressed this issue by inactivating MIL-Q-9858 on 1 October 1996 and redesigning DFARS 246. In doing this DoD pushed contractors and the Defense Contract Management Command (now DCMA) to focus on commercial quality assurance standards and guidelines. DCMA oversight developed measures to streamline existing oversight process to reduce contractor compliance assets by shifting

emphasis from audits/inspections to reviews of contractor processes (12). ISO 9000 allowed DoD to take better advantage of commercial best practices, lessons learned and quality assurance and management techniques and procedures. Contractors no longer had to carry the resource burden of managing two or more quality programs or systems and industry could react more quickly to quality innovations and then put them into action. DoD realized two benefits: cost savings from DoD contractors using commercial higher quality standards, and the cost savings associated with no longer maintaining the MIL-Q-STD regulations and guidelines. This chapter focuses on the DoD relationship towards ISO 9000.

B. DCMA POLICY

1. Contractual Elements

Quality products and services are fundamental to successful military operations, system development and production. The quality of products or services is determined by the extent that they meet (or exceed) requirements to satisfy customer(s) at an affordable cost. The Department of Defense (DoD) acquisition policy is to emphasize development of quality products through the design of the product and its associated processes (22).

The DCMA mission prior to award is to assist in constructing effective solicitations, identify performance risks, assist in selecting capable contractors, and ensure easily administered contracts. Post award, DCMA ensures product, cost, and schedule compliance, including on-site surveillance and program-specific processes. (19) DoD contract quality requirements fall into four general categories (8):

- Contracts for commercial items (FAR 46.202-1)
- Government reliance on inspection by contractor (FAR 46.202-2)
- Standard inspection requirements (FAR 46.202-3)
- Higher-level contract quality requirements (FAR 46.202-4)

Contracting activities select the appropriate category based upon the technical requirements, the complexity, the commercial/Federal application of the components associated with the overall, and the criticality of the associated system (22). When the contracting activity determines a higher-level contract quality requirement is necessary and appropriate, contractors may specify their preferred documented quality/inspection system. This system could be based on (32,33):

More specifically FAR Part 46.401 prescribes (8):

> Government contract quality assurance shall be performed at such times (including any stage of manufacture or performance of services) and places (including subcontractors' plants) as may be necessary to determine that the supplies or services conform to contract requirements. Quality assurance surveillance plans should be prepared in conjunction with the preparation of the statement of work. The plans should specify- all work requiring surveillance; and the method of surveillance.
>
> Each contract shall designate the place or places where the Government reserves the right to perform quality assurance. If the contract provides for performance of Government quality assurance at source, the place or places of performance may not be changed without the authorization of the contracting officer. If a contract provides for delivery and acceptance at destination and the Government inspects the supplies at a place other than destination, the supplies shall not ordinarily be reinspected at destination, but should be examined for quantity, damage in transit, and possible substitution or fraud. Government inspection shall be performed by or under the direction or supervision of Government personnel. Government inspection shall be documented on an inspection or receiving report form or commercial shipping document/packing list, under agency procedures (see Subpart 46.6). Agencies may prescribe the use of inspection approval or disapproval stamps to identify and control supplies and material that have been inspected for conformance with contract quality requirements.

- The appropriate International Organization for Standardization (ISO) 9000 standard
- The appropriate American National Standards Institute (ANSI) / American Society for Quality (ASQ) Q9000 standard
- The appropriate NATO AQAP standard (see Appendix C)
- A canceled Government standard with supplements (i.e., Mil-Q-9858, Mil-I-45208)
- A process control system that meets other recognized industry (but non-ISO/ANSI/ASQ) standards
- A process control system that is equivalent to or better than the ISO 9000 standard

Allowing contractor flexibility to attain the highest level of quality through contractor selected, and subsequently, DoD approved QMS is the goal of SPI. DoD encourages contractors who currently have contracts citing the MIL-Q-9858A and MIL-I-45208A requirements to consider transitioning into commercial quality system standards

via the SPI (22,23). The quality system referenced in a contract is a contractual requirement and the contractor is responsible for instituting and maintaining that quality system. In most cases, the DCMA becomes involved in contract administration support by request of the procuring contracting activity that issued the contract (8,22). It is a common misconception that DoD requires ISO registration. Contractors have the flexibility to adopt any quality assurance and management system so long as it addresses the customer's requirements.

FAR Part 46.202-3-90 prescribes the insertion of a clause covering manufacturing process controls and in-process inspection. The clause introduces the possibility of ISO 9000 insertion in the RFP. The contractor then chooses ISO 9000 or other option. This allows offerors to provide information that will enable the source selection team to assess risk of performance, and to identify those practices the offeror deems important to the project in terms of the risk mitigation. The risk assessment will be based on the ability of the offeror to carry out program requirements and evidence of demonstrated effectiveness.

2. Government Responsibility for Product Quality

The Government bears the responsibility of determining whether the standard is implemented properly and is adequate for the risk involved. That determination usually involves a quality system audit performed by DCMA. The Government does not require any contractor to become certified or registered to ISO standards. FAR Subpart 46.2 outlines guidance concerning contract quality requirements. Specifically, 46.202-4 prescribes higher-level contract quality requirements. Requiring compliance with higher-level quality standards is appropriate in solicitations and contracts for complex or critical items or when the technical requirements of the contract require control of work operations, in-process controls, and inspection; or attention to organization, planning, and work instructions. In the RFP Section L, *Instructions to Offerors* and Section M, *Evaluation Factors for Award*, cover the insertion of higher-level quality system clauses as outlined in FAR 46.311. The objective is for the supplier to define and mitigate the manufacturing process risks associated with the acquisition cycle (4,9).

Based on the thrust toward the use of commercial standards and specifications, ISO 9000 has had an ever-increasing importance to Government contracting. On 18

November 1996, the DCMA (then DCMC) issued Memorandum No. 96-73, Quality Systems Evaluation (Policy), which recognized ISO 9000 and the associated registration process. An abstract of this letter follows:

> DCMA/CAO is to perform ISO 9000 audits on selected contractors if the contractor is moving toward implementation of ISO 9000. Audit results are only revealed to the customer (PMO, Buying Command) and the contractor (35).
>
> In support of the use of ISO 9000, DCMA/CAO will perform full audits when requested by the buying command or if no information is available as to the adequacy of a contractor's quality system the CAO will verify third party registration data, including past audits and the traceability of the registrar to the Registration Accreditation Board (RAB). DCMA will accompany the third party auditors if concurred with by the contractor. When participating with an audit, the CAO auditors shall audit management responsibility, corrective and preventative actions, and internal audits.

Upon successful completion of the audit, DCMA will issue a statement of compliance. According to DCMA, the ISO 9000 Series has two primary roles, quality management and quality assurance. Two Types of ISO 9000 standards guidance standards and contractual standards are currently in use. DCMA representatives will see

ISO 9000 series standards are used in four situations (35). They are guidance for Quality Management, contractual, between first and second parties, second-party approval or validation, and third-party certification or registration.

In most cases all contracts have two "deliverables," the quality system requirements and the goods or services requested. The quality system requirements are as much a contractual requirement as are the goods or services requested. Validation of the quality system is as contractually necessary as validating the serviceability of the goods or services. Quality Systems are a contractual requirement. ISO 9000 fulfills the requirements of a "higher level" quality system.

DCMA specialists must evaluate contractor quality systems for compliance with contractual higher-level contract requirements. The ISO 9000 Standards are the most widely used non-government standards in DoD contracts. When a "higher level" quality system is called out in a contract, that contract has at least two deliverables - the quality

system and the material or services requested. Part of the cost associated with a contract is the cost related to the quality system. Just as we verify the goods and/or services contained in the contract we also must validate the contractual quality requirement cited in the contract. (32,34)

The DCMA One Book, Chapter 4.4, outlines how DCMA personnel will conduct contractor quality systems evaluations. Quality system audits are tailored to examine only those quality elements directed by customers, and/or those elements where existing data does not provide confidence. DCMA personnel evaluate the contractor's quality system for compliance using existing data from credible first, second, or third party audits. Sample verification or confidence in the auditing process may be used to establish the credibility of audits conducted by others. (8,22)

Policy and guidance on the application of quality standards is provided in the FAR Part 46; DFARS Part 246; SECDEF Memorandum of June 29, 1994, subject: "Specifications and Standards-A New Way of Doing Business"; and USD (A&T) Memorandum of December 8, 1995, subject: "Single Process Initiative" (13,19,20). ANSI/ASQC Q-9000, and/or the ISO-9000 series standards are referenced as model quality management systems. Contractors are given the flexibility to respond with their own quality systems. DODD 5000.2-R Part 5 provides quality management guidance and as the others mentioned above will be referenced and further explored throughout the discussion and analysis.

DCMA mission requirements have remained the same and increased in many areas even though DCMA manpower and budgetary resources have decreased significantly, from 26,500 in 1989 to fewer than 13,000 currently (19). Contracting out, or outsourcing, increasing public scrutiny of DoD procurement and budget, and commercial industry unaccustomed to having DoD as a customer have all affected the way in which DCMA conducts business. DCMA's aging workforce has witnessed great internal and external change in DoD procurement since the late 1980s. In order to address these issues, DCMA uses risk planning, assigning a risk rating to suppliers and allocating resources to match the risk associated with the procurement. Risk planning, assessment, and handling are directly correlated to supplier quality assurance. The

DCMA One Book Section 4.2 addresses this area. DCMA risk planning is conducted through review of contract and customer requirements and the identification of quality systems, processes, and characteristics. The latter identification complements the principles of the ISO QMS. (45,57)

DCMA has two tools at their disposal to balance contract insight and administration with the limited resources. The tools are Process Oriented Contract Administrative Services, or PROCAS as it is more commonly called, and Contractor Self-Oversight, CSO. PROCAS is the DCMA approach of prevention and improvement rather than correction to address and manage the contractor to Government relationship. Teaming and partnering between contractor, customer, DCMA, and DCAA are the actions to improve and analyze better quality management process. CSO is an alternative to direct oversight by DCMA. The DCMA and contractor sign a Memorandum of Agreement (MOA) covering interaction, schedule records, and changes. Clearly defined surveillance plans must be in place for CSO to work effectively. The surveillance plan dictates how the CAO will monitor the contract CSO. (54)

The DCMA takes numerous audit approaches to guide their evaluation of a contractor and these approaches are used to discover underlying problems in a quality system affecting areas of concern for the ACO and PCO. There are varying indicators that result in a DCMA Audit of a contractor's quality system: (8)

- Customer request
- Inadequate contractor data to establish confidence
- Unsatisfactory performance
- Defective pricing
- Internal control issues
- TQM program efficiency

Quality system evaluations must be accomplished based on the objective data. Sample verifications of key quality system elements are authorized to validate the credibility of reports of audits conducted by others. DCMA quality system audits focus on the specific elements of the quality system identified for review by the customer, or the elements(s) of the system where confidence in compliance is lacking. (8,22,24)

Generally, DCMA evaluations and audits of contractor quality systems must be performed using (ISO) or American National Standards Institute (ANSI)/American Society for Quality (ASQ) 9000 series quality system models. DCMA specialists invite customer participation in audits of contractor quality systems. The DCMA Audit Checklist guides audit performance. A capable QMS is given a Statement of Qualification by DCMA. Whether the quality system evaluation results are positive or negative, the results must be provided to the DCMA customer(s), because they provide valuable insights into the capabilities of a contractor's quality system. (8,24)

C. DCMA POLICY 2000

1. Policy

DCMA Policy has not undergone any major overhaul since it published *Quality Management Systems – Requirements ISO 9001:2000*. The ISO standard meets the criteria established by FAR Part 46.202-4 as a higher-level quality assurance requirement. It is expected that this standard will be included in DoD contracts via FAR Clause 52.246-11, Higher-Level Contract Quality Requirement. In accordance with continuing policy, the DoD does not require accredited certification to higher-level quality standards, to include industry standards. DoD contractors are required to maintain effective quality systems in accordance with contractual requirements. DCMA issued *Information Memorandum No. 01-142* (IM # 142) on February 13, 2001 providing guidance to the Commanders of Defense Contract Management Districts (CMD), DCMA, and Contract Management Offices (CMO). The following paragraphs focus on DCMA policy according to IM # 142 (24).

Many defense contractors have based their quality management systems on the 1994 edition of ISO 9001, 9002, or 9003. Although it is expected that many defense contractors will continue to base their quality systems on the 1994 editions, DCMA is working closely with the DoD and industry groups to devise an approach for the transition from the 1994 editions of ISO 9001 to the 9001:2000 version, when appropriate. Although DoD does not require certification, the 1994 editions of ISO 9001, ISO 9002, ISO 9003 and ISO 9001:2000 will co-exist for three years for certification purposes. DoD is working toward a streamlined process on defense contracts to simplify implementation of the ISO 9001:2000 when elected by a contractor, provided no increase

in price or fee is required. The transition process will incorporate the Single Process Initiative provisions contained in DFARS 211.273. Transition activities will include the following: (8,22,24)

- Contractors shall notify the contracting officer in writing of this election to include their transition strategy; the use of established Management Councils, including sector and corporate councils, is encouraged and expected
- If DCMA is the cognizant contract administration activity and the contractor elects to update their quality management system from the 1994 edition, DCMA is authorized to monitor the transition, evaluate implementation, and approve and issue appropriate modifications to associated contracts
- If DCMA is not the cognizant activity, the cognizant contracting officer will generate appropriate contract modifications

The ISO 9001:2000 revision replaces 1994 versions of ISO 9001, 9002, and 9003 (43). The 1994 family of ISO 9000 documents originally comprised over 27 standards.

Three of the twenty-seven were contractual standards: ISO 9001, ISO 9002, and ISO 9003. In the 2000 series there will be only one contractual standard. That standard is ISO 9001, referred to as ISO 9001:2000.With the release of the new series, the ISO 9001:2000 is now the only quality management system standard in the 2000 series. ISO 9001:2000 allows the quality management system to be tailored (22). The ISO 9001 clause, which refers to this process, is "1.2-Application." This clause allows a level of flexibility for the adoption of the standard by various businesses (i.e., suppliers who would have previously utilized the ISO 9002 or ISO 9003 standard because of the scope of their business.) Clause 1.2 limits tailoring to the requirements found in clause 7. The quality manual must indicate if the system is tailored and indicate the tailored clauses and provide justification for their exclusion. Tailoring of requirements is not a new concept to the DoD. For many years the DoD buying commands have used tailored quality system requirements in satisfying their needs. Under the 1994 models, suppliers could choose the quality system model, which best represented the scope of the work they performed (i.e., design or development, production, etc.).Now there will be just one quality system model, ISO 9001.Obviously not all suppliers quality systems need to embrace all the clauses (elements) contained in that document. "Tailoring," as it relates to the revised

ISO 9001 standard, simply allows suppliers to identify those quality system clauses (elements), which apply to their quality system (33).

The ISO 9001: 2000 allows suppliers to apply only those specific clauses, which represent the scope of the work that they perform. This use of "application" however only applies to those requirements contained in clause 7 of the ISO 9001:2000 standard, Product Realization. The application can't be used to reduce the scope of suppliers' QMS (8,26,57).

The DCMA One Book Supplier Quality Assurance, Chapter 4, discusses Quality System Evaluations and Audits in section 4.6.3.1.2. DCMA specialists are not to perform new evaluations or audits of previously acceptable ISO 9001 or 9002 contractor quality systems, due solely to a transition from the 1994 versions of the standards to the ISO 9001:2000 version. Specialists should, as necessary, assess contractors' systems associated with the differences between the revisions. Appendix B (ISO to MIL-Q Cross Reference) provides a comparison of ISO 9001:1994 and ISO 9001:2000. As is the normal DCMA policy for Quality System Evaluations, existing credible data must be used in conducting the evaluations; audits must be limited to those clauses where existing credible data does not provide confidence that the system is compliant. Evaluation results may be recorded in any convenient format, indicating how confidence was established for each applicable quality system clause. DCMA must notify the contractor in writing of the results of this assessment. These written notices must identify the applicable quality system standard requirements assessed (8). When assessments indicate significant noncompliance, the written notice must identify the exact areas of noncompliance and request corrective action.

2. Implementation

The utilization of the new ISO 9000 series standards impacts the DoD customer, the DCMA workforce, and the DoD supplier. Due to the coexistence of the two standards series for the next three years, greater attention will need to be placed in the identification of the ISO 9001 revision referenced in contractual documents to ascertain if the ISO 9001:2000 requirement and system are tailored. DCMA breaks down suppliers into two categories when using ISO 9000 based systems, registered/certified or non-registered/non-certified (33). Suppliers can continue to use 1994-based standards and

may be referenced in contracts as long as it satisfies the customer's needs, although registered/certified DoD suppliers with ISO 9000 based systems are driven by registration requirements to adopt the new standard. Documents must reference a contractual standard and a specific version (1994 or 2000). If the ISO 9001:2000 system is tailored, DCMA is the activity assuring the tailored system will satisfy the DoD customer's needs. The worldwide acceptance of ISO continues to influence implementation of QMS. Research external to the interview found that DCMA currently administers approximately 24,000 contracts with higher-level quality requirements produced by approximately 1,100 suppliers. Contract clause 52.246-11 requires the use of a higher-level quality requirement, including ISO 9001 (20). Since the adoption by DoD of ISO 9000 as allowable to use in the early 1990s, registered companies have grown from 225 to approximately 40,000 companies. As of July of 2000, nearly 340,000 registrations of certification existed internationally (15, 25). As of 23 May 2000, ISO Certificates totaled 343,643 in 150 countries. The U.S. has over 30,000, Britain has over 60,000, and Germany has over 30,000. This is an increase 21% in one year (54). A survey of 240 companies revealed some interesting statistics about ISO 9000:1994. (31)

- 89 percent of certified companies and 77 percent of non-certified companies agree that ISO 9000 is a practical quality system for manufacturers. (64 percent of certified and 60 of non-certified companies say it is practical for service providers.)
- 73 percent of certified companies and 67 percent of non-certified companies agree that ISO 9000 will save them money in the long run
- 78 percent of certified companies and 71 percent of non-certified companies say it will "definitely improve quality" in the long run
- 87 percent of certified companies and 76 percent of non-certified companies say ISO 9000 is "necessary to remain competitive"
- ISO 9000 a "value-added quality system"

Since ISO does not issue certificates of conformity to ISO 9000, there is no official ISO database of the number of certificates or registrations issued by independent auditors. The data is from an ISO-sponsored survey of its worldwide membership. (25)

THIS PAGE INTENTIONALLY LEFT BLANK

IV. ISO 9000 FIT INTO GOVERNMENT QUALITY MANAGEMENT REQUIREMENTS

A. INTRODUCTION

How does ISO 9000:1994 fit the Government's Quality Requirements and will ISO 9000:2000 be a better fit? The analysis of this question is based on the data presented in the previous chapters and the appendices. The scope of this chapter considers consistent themes found in the research. The themes are defined and the thesis writer presents an overall impression of those themes to establish conclusions and recommendations for Chapter V.

Appendix H, Interviews of Quality Managers, provides the raw interview data, which serves as the basis for this chapter. The interviews present a sampling of 15 managers, directors, or auditors of quality assurance management departments from companies that are currently ISO 9000:1994 registered, and from the DCMA. Contractor organizations were selected based on their prominent role in the defense industrial base. DCMA representation was selected based on their lead role in organizing and distributing guidance and training on ISO 9000 and expert knowledge of military quality assurance and management. The aggregate list of respondents' companies is presented in Appendix A (List of Companies Participating in Interviews).

The companies selected were manufacturers of hardware and/or software for the DoD. The scope of the thesis did not include representatives from the service industry, but much of the information drawn from this research may apply to the service industry as well. All of the respondents were involved in DoD contracts and are aware of the ISO 9000 Standards and MIL-Q-9858/MIL-I-45208. As a result, the reader must recognize that each respondent brought his own biases toward ISO 9000 standards, registrars of ISO, and the DoD.

Of the 13 private companies that provided interviewees, only one had obtained ISO 9000:2000 registration. All organizations were using an incremental approach to move towards ISO 9000:2000 registration directed from the corporate or enterprise level. Quality systems' planning was done primarily at the corporate or enterprise level while

allowing respective business units and departments to plan execution and implementation. The incremental approach allows one business unit or department to take the lead role in ISO 9000:2000 implementation. The corporation's contracted third party registrar then conducts an ISO 9001:2000 audit. The audit results or lessons-learned are distributed throughout the corporation or enterprise to all other business units seeking ISO registration. Those units, in turn, use the results and lessons-learned to develop their own ISO transition plan. The incremental approach works with only one or two unit audits occurring simultaneously. This allows subsequent units to seek and acquire a higher level of fidelity into each of their respective ISO implementation plans.

Most of the companies maintain departments within their organization or have suppliers that retain MIL-Q quality standards as their QMS. All of the respondents were managers or directors of quality assurance or management within their organization and all had recent experience with ISO Registrars and DCMA. In most cases the person contacted was responsible for the organization's transfer to ISO 9000:2000 and was very familiar with registrars of ISO and the ISO standards. Only one respondent's organizational business unit decided not to meet the ISO 9000:2000 standard.

This chapter consists of three sections, each dealing with a theme emerging from the interviews. These themes were: advantages and barriers, policy vs. perception, and the relationships between defense contractors and DoD.

B. ADVANTAGES AND BARRIERS

The first theme to emerge from the interviews was that of advantages and barriers. This section will draw from interview questions that addressed ISO 9000 registration and use. Of the companies interviewed, none required ISO as a condition of entry onto their qualified supplier list. However, ISO, to varying degrees, is a selection factor. Most defense contractors see ISO 9000 as advantageous for suppliers to have but fall short of requiring ISO 9000 or third party registration. One respondent stated,

> The imposition of the ISO registration process on suppliers could cause financial/technical barriers for them. To alleviate the problem we perform audits to ensure that the supplier has sufficient control in-place to ensure that product provided to us meets or exceeds our customers' requirements.

The degree of confidence in the registration was based primarily on two factors, the confidence the prime contractor had in the registrar of the potential supplier and the past performance data and reputation of the supplier. In all companies interviewed, ISO offers a reduction in the degree of oversight required towards suppliers, dependent on each industry evaluation of specific contract risk (59). A common theme quoted by respondents is:

> Registered suppliers avoid some of the obstacles required to become part of approved supplier base, however, registration is not a pre-requisite.

DoD uses ISO registration in much the same way as commercial firms. ISO registration is a factor to consider during risk management of contractor selection. Knowing that a company follows ISO, presumes that generally accepted baselines of quality management and assurance practices are in use. Third party registration increases the level of assurance by providing a level of confidence that the quality system is actually in use and practiced by the workforce. Since registrars are independent of ISO, no one registrar is identical to the others, and therefore past performance and the ability of the supplier continue to play the critical role in selection. In fact, many defense contractors and suppliers still use MIL-Q-9858 and MIL-I-45208.

The cost and benefits of ISO 9000 registration via a second or third party registrar must obviously be weighed by each organization. Worldwide acceptance of ISO has made it, either intentionally or unintentionally, a requirement for entry into many markets, especially overseas markets. While ISO registration is not mandatory to compete for DoD contracts, ISO has influenced the quality assurance audit and surveillance process, not only overseas, but in the U.S. as well. The influence is reflected in DoD guidance. ISO 9000 is an example of a standard that meets the DoD "higher level quality standard" requirement. Most organizations feel ISO 9000 is necessary to compete internationally. Some organizations retain the position that ISO 9000 is used as a barrier to market entry specifically in Europe, as stated by one respondent.

> ISO is not value-added to our organization. It is more of a marketing tool than an improvement to our quality system. Our registrar's advice and surveillance have been of little use.

It is difficult to deny that ISO 9000 is a barrier to entry in many markets, given its worldwide acceptance. The ISO barrier, whether real or perceived, is based widely on top management's view of ISO's value to the organization.

Many maintain that ISO 9000:1994 was not a significant change from MIL-Q-9858 and that there is little additional benefit or cost to transition to ISO 9000:1994. The primary cost these respondents noted was the high price of third party registration. DoD does not require the third party registration but many markets do, thus adding support to the view that ISO 9000 is a marketing tool. One company position:

> Having previously been a MIL-Q-9858 company, the cost tradeoff between ISO registration activities (including internal audits and other internal efforts) was equally counterbalanced with the absence of frequent ACO/customer quality system evaluations.

Benefits ranged from increased productivity, increased flexibility, and quality assurance discipline, to the absence or reduction of customer inspections provided as a derivative of the ISO Third Party Registration. Others were more skeptical, stating it has not brought a significant advantage to the organization over MIL-Q-9858 but resulted in costing more for the third party registration. Companies seeing ISO as beneficial view ISO as a catalyst to change the corporation's quality culture:

> The most beneficial outcome of ISO is to have an outside registrar to validate the quality cultural changes that need to be made in our organization.

> What we once thought as unrelated to quality is actually related. It effects the whole organization. Previously we looked at the downstream process, ISO brings in the upstream processes that impact the product. Quality goes to management commitment, [and] capable processes on the manufacturing floor. ISO can bring in the discipline to change.

To a great degree, the actual impact of implementing ISO 9000 in an organization depends on the importance the organization places on emphasizing ISO principles and discipline. The standard is not the panacea for quality problems, and without the addition of leadership, management, and a workforce embracing a total quality perspective; ISO has little chance to create a recipe for success in the organization implementing it. When ISO is used as a catalyst for organizational change, incorporating a TQM and process management approach, it can provide meaningful results in quality production, but alone,

without a champion and an organization to build additional processes and systems around ISO 9000, it will merely meet the minimum requirements.

More specifically many saw the ISO 9000:2000 elements of product realization, customer satisfaction, and continual improvement as offering the most significance and concern by defense contractors and the DoD. Product realization is seen as a mixed blessing, providing both gains and drawbacks to industry and the Government. The concept allows for the true commercialization of the QMS; however, the contractor must justify to the Government exclusions sought under the product realization clause. Under the Standard Inspection Clause, the Government holds final approval of any exclusion. Excluding certain provisions not needed for contract quality assurance may provide reduced cost for the Government. Including un-necessary items and clauses under product realization may add unattended cost to a contract where no direct benefit is gained from inclusion of the clause.

Respondents believed the 2000 version of the ISO 9000 series addresses shortcomings with customer satisfaction and continual improvement, but also commented that customer satisfaction and continual improvement introduce new problems and concerns. Concerns surround the abilities of DCMA and registrars, or any auditor's ability, to make accurate measures of customer satisfaction and continual improvement as it applies to DoD contractors. The customer is not easily defined or recognizable in DoD procurement. Many stakeholders are considered customers in DoD. DCMA, DCAA, DLA, Systems Mangers, Program Managers, Congress, and the users alike all have legitimate claim to some aspect of the DoD customer. The program office is the user representative to defense contractors, ISO 9000:2000 has not changed that relationship, but all stakeholders assert some influence as customers of the defense contractor. Registrars and DCMA should consider the unique situation in which contractors face in having DoD as a customer when assessing this area. This is an area that needs to be worked out as ISO 9000:2000 is implemented.

Continual improvement is another area difficult to measure in many instances, especially in mature products and service-based industry. For example, it is easy to see continual improvement in computers over the past few years, but is the same true for

laundry detergent or in the janitorial service? Both laundry detergent and janitorial service are examples of products where it is difficult to see noticeable differences in improvement unless one looks outside the product itself for improvements in management and cost effectiveness. Again it calls upon the auditor and PCO/ACO to properly define how these facets of ISO will be addressed and measured in the contract. In fact it may be in the Government's interest to not evaluate this area at all.

Barriers associated with ISO 9000 discussed by the respondents ranged from the systemic to the resources required in implementing the change. The barriers applied to ISO 9000:1994 as well as implementation of ISO 9000:2000. The resource areas of time, training, and financial cost topped the list. Systematic changes or challenges, as one interviewee said it, were documentation, awareness training, and the establishment of systems to capture required data. Across all industry interviewees concerns were voiced about respective registrars interpretation of ISO 9000:2000 and how future audits will vary and change from the previous version (1994) audits. Nearly all respondents again mentioned culture, which had an overriding importance relative to other factors. If the culture of the organization cannot adapt to progressive ways of doing business, the organization will cease to exist or prosper. The competitive forces of the market place will replace organizations that cannot adapt, evolve and change to meet ever increasing and technologically challenging customer requirements. The general perspective and consolidation of interview comments by industry and DoD is presented below:

The initial barriers or challenges to ISO 9000:2000 certification are:

- An initial and significant effort in mapping or restructuring one's documentation system to align with the standard.
- An initial increase in the need for employee awareness training due to additional requirements
- Establishing the budget for training internal auditors and hiring a registrar.
- Designing a system to capture evidence of improvement programs and upper management's involvement.
- Re-calibration between [company] and [their] registrar regarding some of the new requirements and exactly what they mean. (Based on the 1987 to 1994 transition, the variation of interpretation reduces with time; but the initial differences in opinion starts out fairly wide).

- The culture of "us versus them," between the quality inspectors and production, is difficult to change. The culture change needed is the move to make everyone responsible for quality assurance in the organization, resulting in a better product. Making each one focus on their [sic] processes in quality management so [they] do not have the performance and defect problems to begin with. The goal is to make sure all the various partners in [the] company take responsibility and accept their function for the quality of what they do whether it is a process or a product. This helps every one understand that quality is everyone's business.

C. POLICY VERSUS PERCEPTION

A large degree of misconception and misunderstanding is apparent between the policy of DoD QMS and ISO 9000 and the perceptions of both the DoD and defense contractors. This section is primarily based on interviews (see Appendix H), Quality Process Versus Quality Product and examines areas where disconnects exist between policy reality and policy perception. This section provides insight and understanding into that policy.

Industry respondents were at varying stages in the ISO 9000:2000 transition process. Opinion within organizations varied in the degree to which the new ISO might effect the organization. Those who thought the new version would change the organization's QMS to a great degree seemed to be placing their hopes on continuing to shift organizational quality culture. Respondents saw the external force of ISO registration as a catalyst to make more changes to internal quality systems and move the organization toward more process management to enhance the quality of manufacturing. Dissenting opinion was that ISO changed little and that planning was focused on updating documentation requirements as published by respective registrars to meet the registration to ISO. All organizations that participated in interviews were using an incremental approach to registration, viewed from the corporate or enterprise level.

Some see ISO 9000 registration as a marketing tool rather than a quality assurance tool or standard valuable to the organization, as mentioned in section B of this chapter. To some extent, it may be true. ISO Registrars are independent of ISO and as with any independent organization are subject to the bottom-line of profit in order to survive. A case could be made that ISO is used as a barrier to entry in the market place; especially in Europe where ISO is more predominate. ISO 9000 certification is both a

marketing tool and a good quality management system. ISO 9000 provides no competitive advantage due to its worldwide proliferation. It is best described as a quality system baseline within industry and provides a common international version of generally accepted quality management standards and assurance techniques to provide goods or services in the global market place.

As the reader will see in a later section on quality process versus quality product, meeting a process can still lead to manufacturing scrap. The process must match a set of industry- and organization-specific set of metrics that measure the effectiveness and efficiency of processes that produce an item meeting the conformity of the customer's requirements. Product specific measures, organizational leadership, workforce experience, culture, and training all play a role in total quality. No standard can dictate entrepreneurial uniqueness to guide a manufacturer to it market niche. Two opposing views of ISO 9000:2000 are presented:

First, the "barrier to market entry" view:

> What was unique about ISO was the registration process. It was used as a barrier for entry into the common market. The registration framework makes it successful and perpetuates the success, financially, of the companies that are registrars. It is a product or service the registrars provide for sale. ISO is a commercial product, not a significant customer support.

Second, the view that ISO 9000 makes a difference:

> I see the ISO changes as significant. A heavy emphasis on continuous improvement, management oversight, record meeting. It places more a burden on contractors to document their continuous process improvement. I disagree that the five disciplines talked to in the new ISO were already built into the previous 20 elements.

The Firestone example, introduced previously, brings attention to one of the reasons for the new ISO 9000 standard. ISO recognized, as did many of its members, that ISO 9000:1994 must change and address some of its weaknesses. One major company observed that documenting one's processes and ensuring that the documented processes are followed, as required by the ISO standard, could result in an ISO-certified company producing excellent but useless concrete lifejackets (35). That company went on to

develop a quality system that emphasized continuous process improvement and customer satisfaction, areas in which many felt the ISO 9000:1994 standard were lacking (35).

The eight QMS Principles of ISO are a solution intended to address problems with ISO 9000:1994: such as demonstrated processes, evidence of product conformance, and documentation as well as customer satisfaction and continual improvement (14,35). The new standard places more emphasis on management's involvement in quality systems and process and requires auditors to spend more time and effort verifying effectiveness through interviews of people on the production floor or conducting the service. The shift of ISO 9000 from the 20 elements to the eight management principles provides an excellent framework for teaming and implementing the principles in an integrated approach rather than a stovepipe one. Many organizations had divided the 20 elements into respective departments to administer, creating a stovepipe approach to ISO 9000:1994 implementation. The eight principles, which embody the 20 elements, cause organizations to take an integrated approach to their performance and execution. Some defense contractors perceive the 20-element elimination as a needed improvement.

> The only improvement that I see in the 2000 version is that it is restructured to eliminate the perception that ISO 9000 is 20 separate, stand alone elements that "the quality guy" is responsible to ensure are met. Unfortunately, a large degree of vagueness in the requirements of the standard accompanies the new revision.

Others see the principles and disciplines of ISO 9000:2000 as intrinsic properties of the 20-elements.

> What is obvious to some in the previous 20 elements is not so to others. What organizations see as shortcomings or weaknesses and even strengths of ISO is largely dependent on the culture of the organization implementing ISO.

No matter the opinion, organizations that adopt ISO 9001:2000 will have to demonstrate that their product realization processes are effective and producing quality product. They will also have to demonstrate that product conformity or critical characteristics are acceptable (35), and must establish plans for improvement. Improvements must then be actually demonstrated. Contractual acquisitions for commercial and non-complex items would not normally require higher-level quality

assurance requirements such as ISO 9001:2000. If the requirements of the quality management system are being fully met, then, processes are in control, product conformity levels are at acceptable levels, and substantial plans for continual improvements are in place. (4,14,35)

Interviews and thesis research reflect that ISO 9000 is more effective when used with advanced quality procedures. Quality product development involves a broad range of quality techniques and measurement. Numerous inspection, modeling, and sampling techniques are in use in addition to ISO 9000 by the defense contractors interviewed. The quality system in use, as one respondent put it, " must be flexible and dynamic… with a list of menu options or courses of action to follow to implement… in order to distinguish between a trend and an isolated incident (59)."

One quality manager with an extensive software program more specifically made the following remark,

> We have many pre-ship quality processes. Most are based on the CMM Model [sic] and follow CMMI and internal standard processes [The respondent was referring to the Capability Maturity Model (CMM), and the associated Capability Maturity Model Integration (CMMI)].[1] We have a process that looks at and measures the critical paths of a product; design, build, manufacturing, test and function, focusing on the products' "critical characteristics." We also use break and fix, accelerated life testing to mature our products to measure quality level.
>
> On the production and service side, we have numerous management reviews, various avenues for customer feedback, tracking systems like systems defect trends. All of these procedures are linked to our organization's failure review board involving all product players (stakeholders). Suppliers and customers are a part of the entire process and manufacturing relationship. An output is our Quality System Report Card providing our process to improve.

A clear distinction is made between an organization with the ability to produce a quality product and one that actually does produce a quality product. An organization can meet registration requirements, proving it has a system of quality, but can and may

[1]The respondent was referring to the Capability Maturity Model (CMM), and the associated Capability Maturity Model Integration (CMMI). The Software Engineering Institute at Carnegie-Mellon University developed CMM and CMMI. DoD 5000.2-R requires software-intensive Major Defense Acquisition Programs (MDAPs) to meet certain requirements specified in the CMM.

still produce material that is nonconforming or even defective. A popular analogy can be made between a surgical operation and a quality system and how measures of the system or process may not be appropriate.

> Hospitals are expected to produce quality but performance based on quality alone is never measured, in part because the meaning of the term quality is both elusive and disputed [as the researcher has noted in Chapter II]. For instance, physician claims that quality stems from using the "correct procedure," no matter what the outcome (41).

A surgical procedure or process may be high quality but if it does not match the end result of increasing the health and well–being of the patient, is it successful? The answer to the surgeon may possibly be yes, but to the patient of a surgical procedure the answer is no.

The Government is not required to accept a QMS until it demonstrates that it satisfactorily controls process and product in accordance with the Standard Inspection Clause. QMS demonstrations and audits may not discover faults in QMS until contract execution. Government auditors, while afforded protections outside the scope of ISO 9000, must continue to be diligent in audit and surveillance procedures even under ISO 9000:2000.

Elaborate systems of checking to ensure procedural fidelity are administered but may not meet the results or desired outcome of the customer (41). Organizations that are realizing products must have the institutional ability and discipline to implement the underlying essence and concepts of the ISO 9000 Standard, not merely the "shall" and "will" of the document. In this area ISO 9000:2000 is addressing a major deficiency that has been a source of international criticism. ISO 9000:2000 yields private sector protections not previously provided, and makes ISO 9000:2000 congruent, in many aspects, with the protections of the Government's Standard Inspection Clause.

The ability to become a registered ISO organization and still produce scrap, especially under the ISO 9000:1994 version was evident industry-wide. ISO certification means only that the company's affirmation is that it does what is says it does. The outcome could be good or bad, as seen in the hospital analogy. The ISO effort to address this shortfall is evident in the eight management principles of ISO 9000:2000,

particularly customer satisfaction, continual improvement, and process management approach. The eight-management principles and five "disciplines" of ISO 9000:2000 are too new to develop a statistically sound judgment if the principles and disciplines provide a higher-level of quality assurance. Often only one degree of separation exists between ISO 9000 registered companies, which consistently produce conforming, defect free material and those who are registered and do not. A respondent acknowledged:

> No registration process will guarantee product quality. The guarantee audit would be so expensive that it would be unaffordable, in addition, there are very few people that could perform an audit to the scope and detail required to verify every step in every process is acceptable. Even 100 percent inspection is only 85% effective.
>
> Another respondent stated: ISO registration indicates that you have the minimum necessary business/management processes in place; it is the starting point for stellar quality not the zenith.

The only absolute measure of conformance is 100% inspection and as was realized during the early stages of WW II, to conduct 100% inspection is cost prohibitive in manufacturing mass quantities of goods or technically difficult items to test, like software and modern weapon systems. Measures such as random sampling and statistical process control must be established as part of an organization's metrics to measure product conformance. ISO 9000:2000 provides the requirement for product quality assurance but there are intangibles: warranty, consistency, quest for quality, process tools to continually improve, cost analysis, and product process quality issues and resolution (59).

Another point to consider is that not all registrars or DCMA auditors are created equal, some are more conscientious than others, and each comes with his or her own personal biases and backgrounds influencing the audit (9). Just as not all of the operators of a piece of equipment in a factory are equally trained or equally proficient, neither are registrars and DCMA auditors. In the researcher's view, quality assurance and management requires an integrated product and process development (IPPD) approach of teaming between industry, DCMA, and registrars to provide the greatest level of fidelity to build a quality product through the systems engineering approach and IPPD. The IPPD

and Systems Engineering approach fit well into the ISO quality management principles in addressing continuous process improvement and PQM. As one interviewee responded:

> [You need to] understand the essence of the processes and that is what Process Based Management helps you to do. The fact that everyone is looking at their processes through established metrics, and measuring the process against the metrics, you would be hard pressed to have a major systems failure.
>
> You can fool the auditors but if you use them as a tool to improve your process you can use that information to make real improvements with your company. People within the organization must embrace the need for their role in the quality process of the whole organization and its product.

DCMA plays a critical role in the policy versus perception of a quality system, or process versus the desired outcome of quality conforming product. DCMA's involvement as contract administrator and evaluator of organizational quality systems during solicitation and during daily operations is of critical importance in the dynamic environment of quality assurance in DoD procurements. Experts agree no one standard or preaward survey can provide absolute guarantees of a 100% defect free product. Standards and surveys can and do provide valuable insight into an organizations ability to produce a quality product.

The key to creating a quality product is to find the congruence between quality systems, manufacturing processes, and conforming product. Once congruence is found, then an organization must establish metrics to continually monitor the process and allow feedback at all levels to continually improve and address quality issues associated with not only the product but also the processes used to manufacture the product. When congruence is broken, the source of failure and the process that created the fault must be identified and explored. Corrective action taken then is distributed to all the stakeholders in the process that created the fault. The distribution of corrective action allows for continual process improvement of the organization.

The goal of any quality policy is to address quality risk, as one major defense contractor summarized:

> Quality addresses risk. Well-defined, well-implemented quality systems greatly increase the percent of time you have no defects.

Varying opinions were found on what type of risk ISO 9000 addressed. Critical opinions of the change saw the ISO 9000 update, as a move to focus more on supplier needs than those of the customer. Critics suggest that the ISO standard was "watered down" to allow registrars more latitude in ISO 9000 registration, thus increasing the marketability and profits of registrars of ISO and registrars customers. The elimination of the 20 elements in their opinion allows for broader and greater interpretation of the ISO standard.

Opponents see a gradual trend among registrars favoring suppliers rather than buyers. Opponents believe the ISO focus is on producer risk rather than consumer risk. The focus creates an environment allowing registrars of ISO to certify more companies and thus increase the registrar market share and role in ISO. The researcher could find no evidence to support or deny this claim. However, to some degree this dilemma always occurs in manufacturing. Manufacturers balance producer versus consumer risk daily and manage the tradeoffs the two risks hold. Industry observations espousing ISO focus on producer risk followed these comments.

According to one respondent:

> The buyer community has not been addressed in the 2000 version. The customers of the registrars influenced ISO 2000. I see it as a less effective document and aimed more towards the service industry rather than manufacturing.

According to another:

> The new version is more concerned with producer risk than consumer risk. The ISO standard is neither good or bad, it is not a silver bullet of quality to an organization either. I see three new areas in ISO 2K, continuous process improvement, quality objectives, and customer satisfaction. While these are new to the document does it help be make better widgets? The whole focus of the three is nothing new [and] any good business is doing these things already or they would not be or continue to be in business. The document should be intuitive for any competitive market in a capitalistic society. ISO provides no edge it is generic [;] it wants everyone to be gray.

Proponents of the change believe ISO better matches business movement to a process management approach. The same approach is used in state-of-the-art quality

assurance systems. The new standard also better resembles internationally recognized quality awards programs. The new standard creates a better framework from which an organization can build and define its own QMS.

Often what organizations saw as either strengths or weaknesses of the previous versions of ISO 9000 was based on their own point of reference and ability to understand what some call the implied tasks of ISO 9000:1994. Interviewees saw the change as addressing many of the implied and not so well defined aspects of the 1994 version. The framework of ISO 9000:2000 is consistent with the total quality management concept and DoD 5000.2-R. The common goal in managing an organization is to create an environment so that it excels in all dimensions of products and services that are important to the customer (4). The following table will visually show the consistency between the three with each area outlining their respective tenets.

TQM	ISO 9000:2000	DoD 5000.2-R
Committed Involved Mgmt	Responsible Management	Monitor Critical Processes
Customer Focus	An intrinsic ISO goal	Customer Feedback
Workforce empowered	Internal Quality Audits / Mgt Principle (c.) Involvement of people	Proactive not Reactive
Continuous Improvement	Corrective Action & Process Control / Mgt Principle (f) Continual improvement	Continuous Process Improvement
Partnering w/ Suppliers	Intrinsic Control of Product Goals	Root Cause Analysis & Corrective Action Systems
Performance Measures	Statistical Techniques	Capable Processes

Table 2. TQM, ISO 9000, and DoD 5000.2-R Relationship, [After Refs. 8,26,47].

The respective tenets of TQM, ISO 9000, and DoD 5000.2-R serve a common purpose. They all support a better quality environment. DoD 5000.2-R is a DoD Regulation providing guidance and implementation of the DoD Acquisition System, specifically DoD 5000-2R (Interim), Part 5.2.3. ISO 9000:2000 is an international standard or measure to survey a system's quality. TQM is a management philosophy providing tools and techniques for managers to follow for improved quality systems. (1,4,56) TQM is consistent with the Single Process Initiative set forth by Dr. Gansler in

his 1995 memorandum aligning best commercial practices to be better reflected in DoD acquisition and procurement activities (17). The quality management process shall be capable of the following key activities: (17,23)

- Establish capable processes
- Continuously improve processes
- Monitor and control critical processes and product variation
- Establish mechanisms for field product performance feedback
- Implement an effective root-cause analysis and corrective action system

Achievement of quality requires an effective quality management process in conjunction with effective business and technical practices. Achievement requires engineering and manufacturing practices that emphasize robust design along with enterprise-wide process maturity through continuous process improvement efforts. Benefits include first time pass quality, decreased cycle time, as well as reductions in rework, engineering changes, and inspections. These benefits translate into improved affordability and reduced production transition risk. (4,13,56)

D. THE RELATIONSHIP BETWEEN DEFENSE CONTRACTORS AND DOD

The change in quality assurance philosophy from MIL-Q-9858 to allowing contractors to use equivalent commercial quality assurance systems and ISO 9000 standards has program and contract management implications. Some of these implications are discussed under the Advantages and Barriers section of this chapter. All those questioned agree the DoD SPI and use of the "most effective quality system" continues to allow a better quality environment. SPI and "most effective quality system" do not come without issue.

The key issue is best explained by one of the respondents and addresses an overarching DoD problem facing industry and the DoD in instituting SPI and "most effective quality system."

> The SPI of only one standard to industry is deceiving. MIL-Q and MIL-I were not canceled [sic]. They are not the preferred method according to DoD policy. So when we (DoD) stopped dictating what quality system to use to allow the "most effective quality system," we opened the door for industry to choose the system. Many organizations decided to remain with the MIL-Q and MIL-I standards. DCMA now must not only understand

> ISO 9000:2000 but all of the previous military standards still in use, many industry accepted quality standards like QS 9000 [that] the automobile industry uses, as well as ISO 9000:1994. The way the FAR is written we are discouraged to dictate to an organization any of these systems as long as they meet the "most effective" criteria. The challenge of understanding all of these systems, although there are many similarities between them, is difficult for DCMA to consistently and to appropriately manage across the numerous sectors of business DoD is contracted with.
>
> DoD suppliers' complaint about the cost of having two or more systems prior to SPI is only a half-truth. Most organizations only used one system, MIL-Q; the cost of quality is something an organization will commit to even if it is not contractually outlined. The cost of implementing ISO, if they chose to leave MIL-Q, is only a 5% to 10% increase. The differences between ISO 9000-1994 and MIL-Q 9858 were not significant enough, in my opinion, to warrant significantly more cost. Suppliers wanted DoD inspectors out of their factories and in SPI industry saw a way to accomplish the elimination of in-house DCMA representatives. Industry and NATO's push to use ISO 9000:1994 instead of the Allied Quality Assurance Procedures (AQAPs) (see Appendix C) pushed DoD to make the change to allow QMS like ISO.

One proposed solution to address the numerous QMS that DoD organizations such as DCMA must be versed in is to mandate the use of ISO 9000. All respondents agreed that ISO should not be imposed. The reason stated predominately was the burden it would place on small businesses. Small business may choose to implement ISO. The primary burden is the financial and resource cost of third party registration (16). DoD does not mandate third party registration, only the existence of an adequate QMS. The intent of ISO 9000, like other quality systems, is to add value to the organization through enhanced quality and process control. The expectation is once a system like ISO 9000 is implemented, organizational effectiveness and efficiency resulting in better processes and products absorb implementation costs.

Assume for discussion that DoD mandates use of ISO 9000, and more specifically requires ISO 9000 with third party registration. A DoD ISO 9000 registration mandate could be very problematic and could result in a breakdown of the arms-length relationship between DoD, registrars of ISO, and contractors. The view is based on the underlying issues raised in many of the respondents' comments but one of the interviewees described it best:

> If DoD chooses to mandate ISO, the only way to make it work would be to select one registrar to handle all DoD contracts. This would be required to ensure a level playing field among DoD contractors.

There is also a problem with picking only one registrar. Registrars become financially tied to the successes and failures of the companies they evaluate. The success of the registrar's business is tied to registration, and registrars only get return business if they register an organization. Independent registrars are not, in fact, independent. To ensure this conflict of interest would not occur, DoD would need to pay the selected registrar for all DoD business, instead of having the private organization or contractor assume the cost of implementing a quality system. Currently, DoD can benefit from a company's quality system without absorbing all of the cost for the implementation of that system. The cost of the periodic and third year audits would be too high for DoD to absorb and the conflict of interest issue is not easily resolved. In one quality manager's opinion:

> DoD cannot use the blanket policy of choosing only ISO registered organizations to do business with. Commercial buyers and producers must be better than that (ISO). Selection must be process and skill determined and situation dependent. You want to use source inspection and performance data and feed that into a process of source selection. DCMA and DoD have not done a good job of doing that they have not invented the proper tools to make that process work as well as industry has. A good example of how this works is a vendor-rating program. Product is inspected; performance data is generated and processed into our vendor-rating program across the organization. We use it as a tool for future supplier selection. I see DCMA request the data but I don't see a documented transfer or process to provide the information across DoD organizations.

Under the current regulation, the DoD reaps the rewards of industry applying their own QMS without burdening that cost on Government contracts. DCMA's responsibility is to assure the system best suites the needs of the customer and that the overhead rates properly reflect industry cost.

The DoD acquisition workforce must currently be versed in numerous commercial and military based quality management systems. Education and training cannot only focus on quality standards such as ISO 9000 and ANSI 9000 series, but on industry and market specific quality systems as well, including military QMS. The

education and training of the DoD acquisition workforce is more critical under SPI. Specifically, ISO 9000:2000 training is currently lacking.

The DCMA organizational view is that ISO has not undergone a significant change. Accordingly, the agency is not sponsoring training on the change, beyond conducting an internal review and dissemination of the ISO 9000:2000 Standard. DCMA is encouraging local commands to send QMS lead auditors to training, to conduct "train the trainer" instruction. Once lead auditors are trained they will train the local organizations on ISO 9000:2000 changes. The problem associated with this strategy is that DCMA field activities work under limited budgets. If DCMA as an organization does not recognize the importance of funding training from a corporate level, then what emphases will local DCMA Commanders place on their employees receiving adequate training equivalent to what their industry counterparts are receiving? The lack of DCMA funding to address this issue may result in inconsistent and inadequate audits of industry using ISO 9000:2000 as their QMS. One DoD employee surmised.

> The DCMA Headquarters view is [ISO 9000] 2000 is not significantly different from [ISO 9000:] 1994. The civilian sector sees this [ISO 9000:2000] differently and is committing resources to make the change. DCMA should follow suite, at least partially, to assure our auditors are able to perform an audit at an appropriate level of knowledge and expertise.

Defense industry quality assurance managers interviewed believe that more resources should be placed in training DCMA representatives on ISO 9000:2000. DCMA's ability to adequately audit and provide surveillance for the DoD customer is directly correlated to product quality and performance, which results in long term cost savings over the life of the product or service. A few well-spent dollars for training may result in saving resources and higher quality products for DoD users resulting in decreased cost and greater reliability over a system's life cycle.

Training and education is more difficult with numerous QMS for the workforce to become familiar with. Previously MIL-Q-9858 and MIL-I-45208 provided detailed and prescriptive guidance in the form of two handbooks, commonly referred to as H50 and H51 (38,39). The handbooks provided cases and examples for the auditor of MIL-Q-9858 to use when conducting audit or when approached with varying audit and

surveillance circumstances. No such handbook exists for DCMA to use when applying the numerous audit functions it is asked to perform of military and commercial QMS. Handbooks 50 and 51 are used with MIL-Q-9858 and MIL-I-45208, respectively. The need for case studies and audit surveillance training and experience remains. In the thesis writer's research, no library of consolidated lessons learned is available across DoD or DCMA to serve and to share the daily wealth of knowledge and experience gained by the acquisition workforce in administering and managing QMS. An interactive and integrated approach incorporating best practices and lessons learned would aid DoD and industry in establish a consistent approach to DCMA audit and surveillance.

Training and education are central to cultural change. The introduction of SPI and the "most effective quality system" is slowly changing the cultural relationship of the DoD and defense industry. DCMA culture, in many aspects, is no different than the culture in many other public or private organizations. Culture is a most difficult concept to understand and is often difficult to change. Without the ability to change, organizations in the private sector lose their competitiveness; in the public sector, organizations that will not change soon lose their relevance.

In the public arena measures of success and performance are often ambiguous or conflicting, with no one person controlling the agenda of the organization, and DCMA is no exception. This is not to say organizational change cannot occur. The process of cultural change in public organizations is different in that leaders of the organizations cannot provide rewards for cultural change without budgetary authority, or alternatively laws and regulations may dictate how rewards are given to public organization members. Without the ability to match cultural change to some type of incentive or reward for changing, a catalyst does not exist to make the organization's stakeholders adopt any significant change. Leaders of public organizations often must be much more creative in incentivizing change, for without incentive an organization's culture will remain the same. One DCMA quality manager spoke about the DCMA view toward ISO:

> In 1988 DoD wanted nothing to do with ISO 9000. The culture, while slowly changing, still has yet to wholly embrace the SPI and ISO 9000. Culture is difficult to change. The aging of our workforce, the decline in our quality assurance workforce numbers from 24,000 in 1995 to 12,000 currently [numbers are approximate] and our inability to attract some of

> the best talent in the field of quality assurance and management are factors affecting the DCMA culture.

The dominant view is that DCMA culture has changed, but still has some areas to improve. Of greatest concern to industry was the "graying" DCMA workforce trained under the detail specifications and adversarial relationships between DoD and industry of the past. The difficulty of DCMA to attract entry-level and apprentice employees to its workforce is a Government-wide issue. Positions within the Federal Government are an unattractive alternative to careers in the private sector, given the high employment rates of the 1990s. Federal workforce reductions, particularly those in the DoD, eliminated many of the junior DoD employees through Federal protection of senior DoD workforce members, causing a potentially severe problem in the ability of the DoD civilian workforce to address future missions. One defense industry observer said,

> …DCMA reduced their personnel by two-thirds over the past decade [and] all you had left was older, more senior employees. These employees come from a past culture of inspection and monitoring, [reinforcing the position] that we (DCMA) cannot trust the contractor. You reach a point where it is very difficult for DCMA to change the culture. It is a generational issue. They (DCMA) are being taught, trained, and told to do it differently but can't or won't change due to the past cultural influence. The environment has become increasingly more technical with change occurring more rapidly than in the past.

According to some DoD officials industry pushed for the issuance of the Single Process Initiative (SPI) in hopes to reduce and or eliminate the amount of DCMA oversight and surveillance (23,59). What SPI failed to eliminate for industry, severe DCMA budgetary and resource constraints did. DCMA oversight and surveillance little resembles what it was in the 1980s. SPI and resource constraints have forced DCMA to refocus its audit and surveillance techniques from oversight to insight. The researcher does not see this as a weakness of DCMA but rather a challenge to continue to ensure products conform to the contract performance specifications within the limits of public funds.

Some industry respondents argue that DCMA should reduce oversight with ISO registered companies. The best approach seems to be based on various factors, and third-party ISO registration is one. DCMA must base the amount of oversight and audit it

conducts on accurate estimates of the risk associated with the contract and DCMA's quality assurance role should focus on this area. DCMA cannot become detached from the customer's product requirements. The DCMA workforce needs a clear understanding of customer requirements due to their contract oversight responsibilities. DCMA ACOs and QARs are the first and often only representation the user has on the production floor. Here lies significant risk to product conformity if DCMA fails to understand and properly recognize customer requirements.

Under constrained resources the DoD should make use of its risk management system to evaluate what level of contract oversight is appropriate. DoD organizations like DCMA should consider internal organizational competencies and strengths as part of their risk management evaluation of defense contractors. Many defense industry quality managers observed the following excerpt:

> The registrars are head-and-shoulders above DCMA on their ability to evaluate compliance to the ISO Standard. They (ISO) are much more capable of understanding the systems evaluation of an organization and the organization's written procedures to match the system. Registrars look at the entire business system. Registrars are not very good at looking at a product and measuring its conformity and compliance to the procedures. DCMA is hardware oriented and much more familiar with the hardware requirements.

And a similar observation:

> There are differences among registrars and differences among DCMA auditors. Government representatives come from different agencies, from various areas and communities, with varying objectives against the same contract. DoD agencies waste time with the infighting that occurs between the various DoD stakeholders. It constrains DCMA and all the other DoD agencies to adequately evaluate an organization because DoD cannot reach consensus on what they expect of the contractor performance against the contract. The roles of contract administration are not agreed upon between DCMA and the buyer.
>
> The PCO and ACO must clearly designate and define the areas of contract administration and procurement functions. The resident DCMA representatives should take the lead in deciding the jurisdiction of the PCO and the ACO in many of these matters.

The DoD must provide clear guidance to DCMA as to what and how they are to be used as a tool to mitigate contract risk. DCMA is not resourced financially or, in

manpower (adequately trained and in numbers) to properly address all of the missions it is asked to perform. DoD users of DCMA must insure the scope of audits and surveillance required is clearly defined. This helps ensure resources are not wasted on non-value added tasks. Third party ISO registration is just one area, of many, that DCMA must evaluate and the extent of confidence that DCMA should place on the registration.

There is not a cookie cutter answer to the right quality assurance program; approaches vary from industry to industry and within industry sectors. ISO 9000 is not a silver bullet and once shot or put into place, it does not necessarily mean output will be flawless. Oversight and audit personnel must then build a broad base of knowledge, experience, and efficiency in performing and carrying out oversight and audit functions. Auditors and quality assurance specialists must go to the shop or factory floor and speak to the employees that actually put quality into the product through their own skill, knowledge, and pride in the outcome of their respective manufactured item or service.

Market and industry analysis and research is key to making a proper assessment of a quality processes existence in whatever area the auditor or contracting officer is working. Armed with this knowledge, oversight and audit functions can carry out their analysis effectively resulting in little interference creating an environment where Government auditor and contractor team develop and produce the best value outcomes for both industry and Government. System managers, contracting officers as well as auditors of quality management must make a quality assurance determination. The costs and benefits of a contractor's quality management system must be evaluated to determine that the quality system that will produce the desired outcome sought by the buyer. This determination must be made on a contract-by-contract basis. (3,9,21)

Some observers advocate that successful completion of ISO registration should be equivalent to a satisfactory preaward survey. Numerous problems are associated with this assertion, which brings to light many of the weaknesses of the ISO 9000 certification. Proponents argue ISO auditors use many survey procedures that are almost exactly the same as are used in preaward surveys. While to some extent this is true, the ISO audit for registration occurs once, with cursory audits every 6 months performed by ISO

registration teams. Complete reviews are carried out only after three years of being registered as ISO 9000 compliant quality organizations (9,53). This frequency and depth may not be enough to ensure a quality system meeting the needs of a particular procurement.

As was mentioned earlier, every quality system must be evaluated on a case-by-case basis as it applies to the given procurement circumstance. For example, assume that the US Army has contracted with a company to manufacture a replacement for its aging medium truck fleet. One of the contractors in the competitive range is an ISO 9000 certified company but has not produced a truck of this type and series since World War II. It would be advisable, and appropriate within the Standard Inspection Clause, to review the company's current quality system. Concerns throughout industry mention that registered auditors supposedly qualified by the ISO fail to provide adequate guidance and measures in certifying organizations as ISO 9000 compliant. (3,14,37,53).

Who then will be able to distinguish the difference between good or poor ISO 9000 auditors if not through the Government's own oversight and auditing groups? FAR Part 46.202 prescribes that the Government "bears the responsibility of determining whether the standard is implemented properly and adequately," not the ISO. One interviewee whose views were representative of the majority opinion on DCMA oversight offered:

> The amount of surveillance or oversight should not be based on any redundancies found between registrars and DCMA but driven more by how well the process is working and measuring up to the oversight DCMA feels they need to conduct and as to how we are evaluated to contractual performance measures. The relationship, if one exists, is if ISO 9000 has helped us to improve and organize our process to a point where DCMA is more confident, not the ISO registration. It is a matter of confidence and risk associated with the contract, not a correlation of registrars and DCMA.

The Government would assume significant risk in delegating audit and oversight authority to any outside organization. The Government risks losing the opportunity to guide and mentor contractors through the acquisition cycle and its association with the respective contractor. The Government would also risk losing valuable insight required to maintain the capability for monitoring and establishing a base from which future

quality assurance auditing must occur. ISO 9000 certification should be promoted and is encouraged by DoD. While ISO 9000 is no guarantee of a quality process or product it provides a certain level of confidence towards meeting requirements in quality assurance the Government might expect inherent to a contractor's quality system process.

Publicity concerning low quality can ruin the reputation of a company and can have the same effect on any DoD program where public trust is involved and expected in any procurement (3,51). DoD has worked very hard over the past decade to reverse a loss of public trust associated with some procurement activities in the 1980's (23,44). DoD must be aware that suppliers that are QS 9000 certified, such as Firestone, may pass the surveillance audit, but the customer is still not guaranteed protection from defects (9). In the public sector, the Government is held accountable for the actions of its suppliers. Only when the contractor and Government take proactive efforts can a truly effective and efficient quality management system work.

THIS PAGE INTENTIONALLY LEFT BLANK

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

ISO 9000: 2000 assimilates the 20 elements of ISO 9001:1994. The eight quality management principles and five disciplines of ISO 9000:2000 incorporate the essence of the 20 elements. ISO intent is for the 2000 version to address shortcomings of the 1994 version and to update ISO to current quality management and assurance practices and techniques.

A lack of understanding of the limitations and capabilities of ISO 9000 exists within the DoD acquisition workforce and defense contractors. Neither ISO 9000:1994 nor ISO 9000:2000 guarantees high quality product if the QMS system is not tailored to the product or the workforce fails to follow the processes and practices of the QMS. The ISO 9000:2000 focus on management involvement, process quality management, continual improvement and customer satisfaction recognizes the essentiality of management involvement. ISO 9000:2000 provides guidelines for building an environment that encourages and supports the process outcomes desired by the customer. Whereas ISO 9000:2000 is no silver bullet, it will help to achieve a clear understanding of customer requirements, emphasis on quality from the front-line workforce to corporate executives, and proven procedures monitored by appropriate metrics which allow for contractual improvement arm an organization with the tools to consistently produce conforming products and thus higher customer satisfaction.

ISO 9000:2000 can provide the foundation and framework for a quality-achieving organization but without the materials (the policies, the techniques, the procedures, and the metrics) discussed in Chapter's II-IV, all that remains is a frame of a house, an empty shell, never realizing its QMS potential.

The role of DCMA, and other DoD contract management activities, is critical in an environment of misplaced trust and misunderstood capabilities. DCMA is the DoD ombudsman, the frontline worker, and the advocate who provides QA oversight and inspection of products destined for the Department of Defense. Quality assurance specialists assigned to DCMA have the key role as the Government's quality assurance

representative who approves the quality management system for use in producing a particular warfighting system. Application of ISO 9000:2000 must meet their standards.

B. CONCLUSIONS

The list that follows is a consolidation of the conclusions resulting from this thesis research.

- DCMA role is more complex under the SPI. Under the SPI DCMA is responsible to evaluate numerous QMS. Prior to 1996, with few exceptions, it was only the MIL-Q- Standards.
- ISO provides a baseline or framework for a QMS. Culture, manufacturing ability, technological know-how, leadership, management emphasis, and process quality control and management metrics provide the highest level of confidence and reduction of risk associated with a procurement. However, ISO registration does not guarantee to the DoD that defense contractors will manufacture a conforming product or even understand the customer's requirement through the contract and SOW.
- ISO 9000:2000 contains the necessary elements of a quality management system that, if correctly applied, is suitable for higher-level quality requirements. In every case the QMS must be examined against the quality requirements of the product itself. This is accomplished in accordance with the provisions of the Standard Inspection Clauses used in all Government contracts.
- ISO 9001:2000 principles and disciplines integrate the 20 elements of ISO 9001:1994. The integration reduces a stovepipe approach to QMS implementation and utilization. The ISO 9000:2000 takes a more proactive approach than ISO 9000:1994, considering as organization's culture and environment, leadership attention, and customer.

C. RECOMMENDATIONS

The list that follows is a consolidation of the recommendations based on the conclusions and information gathered from this thesis research.

- The Department of Defense should use ISO 9001:2000 as its benchmark Quality Management System for use when a higher-level quality is required.
- The Defense Acquisition University and applicable service schools should teach ISO 9000:2000 as the quality management system baseline. Additionally, these schools should describe the application of ISO 9000:2000 in DoD contracts.
- Buying activities should work closely with DCMA to ensure a systematic approach for contractual implementation of ISO 9001:2000

- DCMA should continue its current practice of issuing a Statement of Qualification to contractors found in compliance with higher-level contract quality system standards, e.g., ISO 9001:2000.
- Interpretation of ISO 9001:2000 language should also be addressed through internal DCMA guidance and DAU training.
- DCMA in conjunction with DAU schools should establish a virtual library for use DoD-wide, capable of providing the instructional tools that Handbooks 50 and 51 gave the acquisition workforce under MIL-Q-9858 and MIL-Q-45208.
- DCMA should maintain a library, which contains a compilation of defense contractors who have used ISO 9000:2000, their Registrars, contractors' history of QMS performance, and lessons learned. This resource would provide current and future acquisition employees information upon which to base future ISO 9000 QMS decisions.
- USD (AT&L) should establish a policy that addresses current and future QMS updates specifically focusing on contractual aspects of QMS updates.
- DCMA should continue to update its QMS checklist to reflect changes implemented by ISO 9000:2000.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A. LIST OF COMPANIES PARTICIPATING IN INTERVIEWS

AM General

Boeing

General Dynamics

Honeywell

Lockheed Martin

Motorola

Northrop-Grumman

Oshkosh

Raytheon

Stewart and Stevenson

TRW

United Defense

DCMA-East

DCMA-HQ

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B. ISO TO MIL-Q CROSS REFERENCE

MIL-Q-9858	94-9001	94-9002	94-9003	94-9004
1.1, 1.2	0	0	0	1
1.3	4.2	4.2	4.2	5
2	0	0	0	0
3.1	4.1.2.1	4.1.2.1	4.1.2.1	4/5.5/5.2.3
3.2	4.3	4.3	0	5.3.3/8.3/8.25
3.3	4.9.1	4.8.1	0	11.3/17.2
3.4	4.16	4.15	4.4/4.6	5.3.4/17.3
3.5	4.14	4.13	0	15
3.6	0	0	0	4.3.2/6
4.1	4.5	4.4	4.3	17.2
4.2	4.11	4.10	4.6	13
4.3	4.11	4.10	0	0
4.4	4.11	4.10	0	0
4.5	4.2	4.2	0	0
5.1	4.6	4.5	0	9
5.2	4.6.3	4.5.3	0	9.5
6.1	4.10	4.9	0	11.2/12.1
6.2	4.9	4.8	0	10/12.2
6.3	4.10.3	4.9.3	4.5	12.3
6.4	4.15	4.14	4.9	16
6.5	4.13	4.12	4.8	14

MIL-Q-9858	94-9001	94-9002	94-9003	94-9004
6.6	4.2	4.18	4.12	20
6.7	4.12	4.11	4.7	11.7
7.1	0	0	0	0
7.2	4.7	4.6	0	0
8	0	0	0	1

Table 3. MIL-Q-9858 to ISO 9000:1994 Family, [After Ref. 3].

ISO/FDIS 9001:2000	ISO 9001:1994
1 Scope	**1**
1.1 General	
1.2 Application	
2 Normative references	**2**
3 Terms and definitions	**3**
4 Quality management system [title only]	
4.1 General requirements	4.2.1
4.2 Documentation requirements [title only]	
4.2.1 General	4.2.1 + 4.5.1
4.2.2 Quality manual	4.2.1
4.2.3 Control of documents	4.5.1 + 4.5.2 + 4.5.3
4.2.4 Control of quality records	4.16
5 Management responsibility [title only]	
5.1 Management commitment	4.1 + 4.1.2.2 + 4.2.1
5.2 Customer focus	4.3.2
5.3 Quality policy	4.1.1
5.4 Planning [title only]	
5.4.1 Quality objectives	4.1.1 + 4.2.1
5.4.2 Quality management system planning	4.2.3
5.5 Responsibility, authority and communication [title only]	
5.5.1 Responsibility and authority	4.1.2.1
5.5.2 Management representative	4.1.2.3
5.5.3 Internal communication	
5.6 Management review [title only]	4.1.3
5.6.1 General	4.1.3

ISO/FDIS 9001:2000	ISO 9001:1994
5.6.2 Review input	4.1.3
5.6.3 Review output	4.1.3
6 Resource management [title only]	
6.1 Provision of resources	4.1.2.2
6.2 Human resources [title only]	
6.2.1 General	4.1.2.2 + 4.2.3 + 4.18
6.2.2 Competence, awareness and training	4.18
6.3 Infrastructure	4.1.2.2 + 4.9
6.4 Work environment	4.9
7 Product realization [title only]	
7.1 Planning of product realization	4.2.3 + 4.9 + 4.10.1
7.2 Customer-related processes [title only]	
7.2.1 Determination of requirements related to the product	4.3.2 + 4.4.4
7.2.2 Review of requirements related to the product	4.3.2 + 4.3.3 + 4.3.4
7.2.3 Customer communication	4.3.2
7.3 Design and development [title only]	
7.3.1 Design and development planning	4.4.2 + 4.4.3 + 4.4.6 + 4.4.7 + 4.4.8
7.3.2 Design and development inputs	4.4.4
7.3.3 Design and development outputs	4.4.5
7.3.4 Design and development review	4.4.6
7.3.5 Design and development verification	4.4.7
7.3.6 Design and development validation	4.4.8
7.3.7 Control of design and development changes	4.4.9
ISO/FDIS 9001:2000	ISO 9001:1994
7.4 Purchasing [title only]	

7.4.1 Purchasing process	4.6.2
7.4.2 Purchasing information	4.6.3
7.4.3 Verification of purchased product	4.6.4 + 4.10.2 + 4.10.3 + 4.10.4
7.5 Production and service provision [title only]	
7.5.1 Control of production and service provision	4.9 + 4.10.3 + 4.15.6 + 4.19
7.5.2 Validation of processes for production and service provision	4.9
7.5.3 Identification and traceability	4.8 + 4.10.5 + 4.12
7.5.4 Customer property	4.7
7.5.5 Preservation of product	4.15.2 + 4.15.3 + 4.15.4 +.4.15.5 + 4.15.6
7.6 Control of monitoring and measuring devices	4.11.1 + 4.11.2
8 Measurement, analysis and improvement [title only]	
8.1 General	4.10 + 4.17 + 4.20.1
8.2 Monitoring and measurement [title only]	
8.2.1 Customer satisfaction	
8.2.2 Internal audit	4.17
8.2.3 Monitoring and measurement of processes	4.9 + 4.17 + 4.20.1
8.2.4 Monitoring and measurement of product	4.10.2 + 4.10.3 + 4.10.4 + 4.10.5 + 4.20.1
8.3 Control of nonconforming product	4.13.1 + 4.13.2
8.4 Analysis of data	4.14.2 + 4.14.3 + 4.20
8.5 Imp rovement [title only]	
8.5.1 Continual improvement	4.1.3
8.5.2 Corrective action	4.14.1 + 4.14.2

8.5.3 Preventive action	4.14.1 + 4.14.3

Table 4. ISO 9001:2000 to ISO 9001:1994, [From Ref. 55].

APPENDIX C. NATO AQAP

NATO Quality System Standards (AQAP's)

NATO has established a set of standardized procedures in an effort to support quality acquisition activities between North Atlantic Treaty Organization (NATO) member nations. This approach ensures each NATO nation performs consistent quality assurance activities. The two NATO Standardization Agreements (STANAGs) that govern NATO quality assurance activity are the STANAG 4107 and STANAG 4108.

The STANAG 4107, titled Mutual Acceptance of Government Quality Assurance, sets forth the terms and conditions under which mutual government quality assurance of military material and services is to be performed by the national authority of one NATO country on request of another NATO country or NATO organization. The STANAG 4108, titled Allied Quality Assurance Publications (AQAP's), concerns the standardized development, updating and application of the AQAPs in the procurement of NATO defense material.

The original AQAP's established for quality assurances were numbered 1 through 15. These AQAP's were similar to documents used by the U.S. DoD for quality assurance activity. AQAP-1 was similar to MIL-Q-9858A, AQAP-2 was similar to MIL-HDBK-50, AQAP-4 was similar to MIL-I-45208A, etc.

In the early 1990's, NATO recognized that quality was becoming a major factor in international trade and that the ISO standards offered harmonization of NATO quality concepts and terminology with the European Community and other countries world-wide. NATO decided to revise the existing AQAP standards in order to embrace these new international quality standards.

In February 1993, NATO canceled the AQAP 1-15 documents and adopted a new series of AQAP's that incorporate the ISO 9000 series quality system standards.

SUPERSEDED OR CANCELED AQAP's

AQAP NUMBER	DISPOSITION
AQAP-1	Superseded by AQAP-110
AQAP-2	Superseded by AQAP-119
AQAP-3	Canceled
AQAP-4	Superseded by AQAP-130
AQAP-5	Superseded by AQAP-119
AQAP-6	Superseded by ISO 10012-1
AQAP-7	Superseded by ISO 10012-1
AQAP-8	Transferred to AC/301
AQAP-9	Superseded by AQAP-131

AQAP-11	Transferred to AC/301
AQAP-13	Superseded by AQAP-150
AQAP-14	Superseded by AQAP-159
AQAP-15	Superseded by ISO 8402

This new series of standards is sometimes referred to as the "Century Series" because of its numbering system.

AQAP-100 - General Guidance on NATO QA
AQAP-110 - NATO QA Requirements for Design, Development, and Production
AQAP-119 - NATO Guide to AQAPs - 110, -120 and -130
AQAP-120 - NATO QA Requirements for Production
AQAP-131 - NATO QA Requirements for Final Inspection
AQAP-150 - NATO Quality Assurance Requirements for Software Development
AQAP-159 - NATO Guidance for the Use of AQAP-150
AQAP-160 - NAT0 Integrated quality requirements for software throughout the life cycle.
AQAP-169 - NATO Guidance for the Use of AQAP-160
AQAP-170 - NATO Guide for the Delegation of Government Quality Assurance
STANAG 4107 - Mutual Acceptance of Government Quality Assurance and Usage of the Allied Quality Assurance Publications
AC/250 -HNBK - The Group of National Directors for Quality Assurance

Identified below are the NATO Contractual AQAP's that directly reference the ISO 9000 contractual standards:

AQAP 110: NATO Quality Assurance Requirements for Design, Development, and Production directly references the elements contained in the ISO 9001 standard.

AQAP 120: NATO Quality Assurance Requirements for Production directly references the elements contained in the ISO 9002 standard.

AQAP 130: NATO Quality Assurance Requirements for Inspection directly references the elements contained in the ISO 9003 standard.

It should be noted that there are differences between the AQAP's and ISO 9000 quality system standards. The AQAP standards contain additional requirements (supplements) to certain ISO elements. These supplements provide additional direction and guidance on NATO quality system needs.

Governments and organizations sometimes place contracts with contractors located outside their own country. Contract administrative oversight and support for those contracts may be available via established International Agreements and/or Memorandums of Understanding (MOUs) with the various nations and organizations. Contract administrative support may also be available through the Defense Contract Management Agency International (DCMAI) which has support and oversight capabilities in many countries

APPENDIX D. ISO FAMILY

The ISO 9000 Family

The standards, guidelines and technical reports which make up the ISO 9000 family and which are listed below are available separately, or as collections. The ISO 9000 Compendium presents the ISO 9000 family in hard copy form.

Standards and guidelines	Purpose
ISO 9000:2000, *Quality management systems - Fundamentals and vocabulary*	Establishes a starting point for understanding the standards and defines the fundamental terms and definitions used in the ISO 9000 family which you need to avoid misunderstandings in their use.
ISO 9001:2000, *Quality management systems - Requirements*	This is the requirement standard you use to assess your ability to meet customer and applicable regulatory requirements and thereby address customer satisfaction. It is now the only standard in the ISO 9000 family against which third-party certification can be carried.
ISO 9004:2000, *Quality management systems - Guidelines for performance improvements*	This guideline standard provides guidance for continual improvement of your quality management system to benefit all parties through sustained customer satisfaction.
ISO 19011, *Guidelines on Quality and/or Environmental Management Systems Auditing* (currently under development)	Provides you with guidelines for verifying the system's ability to achieve defined quality objectives. You can use this standard internally or for auditing your suppliers.
ISO 10005:1995, *Quality management - Guidelines for quality plans*	Provides guidelines to assist in the preparation, review, acceptance and revision of quality plans.
ISO 10006:1997, *Quality management - Guidelines to quality in project management*	Guidelines to help you ensure the quality of both the project processes and the project products.
ISO 10007:1995, *Quality management - Guidelines for configuration management*	Gives you guidelines to ensure that a complex product continues to function when components are changed individually.
ISO/DIS 10012, *Quality assurance requirements for measuring*	Give you guidelines on the main features of a calibration system to ensure that measurements

Standards and guidelines	Purpose
equipment - Part 1: *Metrological confirmation system for measuring equipment*	are made with the intended accuracy.
ISO 10012-2:1997, *Quality assurance for measuring equipment* - Part 2: *Guidelines for control of measurement of processes*	Provides supplementary guidance on the application of statistical process control when this is appropriate for achieving the objectives of Part 1.
ISO 10013:1995, *Guidelines for developing quality manuals*	Provides guidelines for the development, and maintenance of quality manuals, tailored to your specific needs.
ISO/TR 10014:1998, *Guidelines for managing the economics of quality*	Provides guidance on how to achieve economic benefits from the application of quality management.
ISO 10015:1999, *Quality management - Guidelines for training*	Provides guidance on the development, implementation, maintenance and improvement of strategies and systems for training that affects the quality of products.
ISO/TS 16949:1999, *Quality systems - Automotive suppliers - Particular requirements for the application of ISO 9001:1994*	Sector specific guidance to the application of ISO 9001 in the automotive industry.

Table 5. ISO 9000:2000 Family, [From Ref. 25].

The US Equivalents to the ISO Family

ISO 9000 Is The Same As ANSI/ISO/ASQ Q9000

ISO9000 = ANSI/ISO/ASQ Q9000

ISO9001 = ANSI/ISO/ASQ Q9001

ISO9004 = ANSI/ISO/ASQ Q9004

ISO9000 is the international reference

ANSI/ISO/ASQ 9000 is the U.S. reference (39)

APPENDIX E. EXECUTIVE AND DOD POLICY GUIDANCE

- Office of Management and Budget Circular A-76
  - Federal policy implementing Federal Activities Inventory Reform Act
  - Authorizing the use of nongovernmental standards and specifications in contracts and the procurement of "off the shelf" (commercial) items for DoD use
  - Applicable to the majority of executive agencies Government should not compete with its citizens Government shouldn't carry on any activity if product or service can be procured more economically from commercial sources

- USOD Deutch Policy Letter Dated 14 Feb 94
  - Program offices are authorized to use ISO ANSI/ASQC Q9000 Quality Series standards as follows:
    - In contracts for new programs
    - In follow-on efforts
    - In current contracts on a case-by-case basis
    - Third party registration ***NOT*** required
    - Third party registration ***NOT*** a substitute for Government oversight
    - Commercial level quality systems will be recognized if able to satisfy Government's needs

- USD Perry Policy Letter Dated 29 June 94
  - Redefines order of precedence for specs and standards, performance specs, commercial Specs
  - MILSPECS and MILSTDS (only with waiver)
  - Change in DFAR
  - All MILSPECS and MILSTDS related to management and manufacturing will be phased out suppliers encouraged to use commercial standards
  - Reduce government oversight

- SECDEF Memorandum May 10, 1995
  - Subject: Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition.

- Quality products are best achieved through integrated developments of the product and its associated manufacturing and support processes, through a systems engineering approach.

- SECDEF Memorandum Dec. 6, 1995
  - Subject: Common Systems / ISO-9000 / Expedited Block
    - DoD policy to allow use of single processes in a contractor's facility. Major DoD initiative to allow industry to be more efficient, improve quality and reduce overall cost of acquiring products

- USD (A&T) Memorandum Sept. 18, 1997
  - Subject: "Requiring Processes on Contract"
    - DoD should not require processes in solicitations and contracts
    - DoD should rely on performance based requirements whenever practicable

- Principal Deputy Under Secretary of Defense (PDUSOD) Policy Mr. Dave Oliver letter March 19, 2001
  - Subject: ISO 9001:2000 Quality Management Systems, Transition
    - Monitor contractor transition to new standard

DCMA Policy from DCMA "One Book Supplier Quality Assurance Chapter 4.4

- MG Drews letter dated Nov 18, 1996.
  - DCMA must assure organizations quality system complies with contract requirements and use existing data for evaluating compliance of organizations quality system
  - DCMA must audit when:
    - existing data unavailable or inadequate
    - directed by customer
    - organizations performance indicates
    - system not in compliance with contract
    - requirements
    - quality system has been substantially
    - changed
  - Evaluation of Quality System two basic methods:
    - Evaluation by assigned specialists

- Formal system audit

- Quality System Evaluation will be performed on the quality system cited in the contract
- DCMA Personnel Qualifications:
  - DAWIA Level II
  - Manufacturing and QA career field, DCMA auditors meet ISO 10011-2 requirements
- Quality System Audit
  - Tailored to reflect scope of contract requirements
  - Records to indicate how confidence established in DCMA Audit Checklist used
- Results of Quality system audit:
  - Notification to contractor
  - Notification to our customer
- If Quality System is found to be in compliance, DCMA will issue a "*Statement of Qualification*" to contractor
- DCMA STATEMENT OF QUALIFICATION:
  - Quality System Qualification
  - Name of Company Qualified
  - Applicable Standard
  - Document dated and signed by
  - DCMA CMO Commander
  - Copy of document sent to customer(s)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX F. ISO PROCESS MANAGEMENT APPROACH

The quality management system described in the revised standard is based on quality management principles that include the "process approach" and "customer focus." ISO 9001:2000 and ISO 9004:2000, both, apply a process approach. The "20 element" structure of ISO 9001:1994 has been replaced by this process-based quality management system (PQM), which is shown schematically in Figure 3, below.

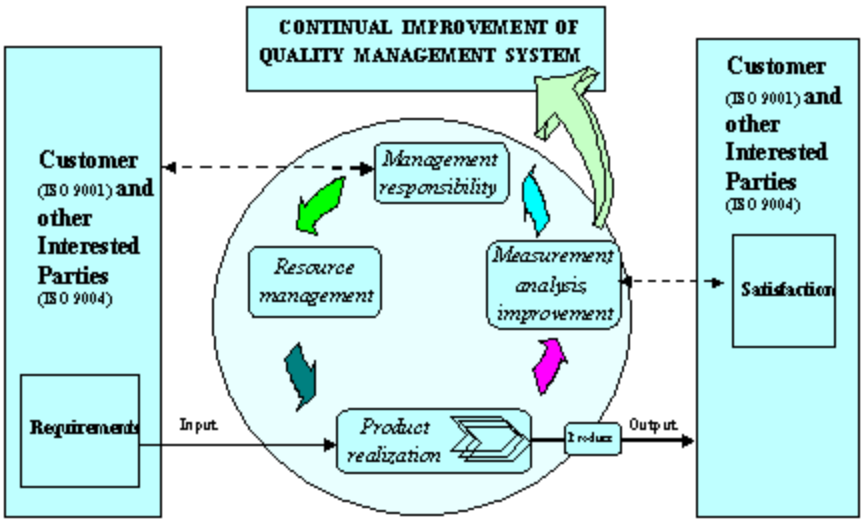


Figure 3. Model of a Process Based Quality Management System, [From Ref.48].

The adoption of these principles should provide customers with a higher level of confidence that products will meet their needs and increases their satisfaction (28,48). ISO 9000:2000 clause 3.4.1 defines a **"Process"** as any activity or operation, which receives inputs and converts them to outputs (26). The output of one process may directly form the input to the next process and the final product is often the result of a network or system of processes. Almost all activities and operations involved in making a product or providing a service are processes. Inputs and outputs may be tangible or intangible. Examples of inputs and outputs may include equipment, materials, components, energy, information and financial resources, among others (25). For organizations to function,

they have to define and manage numerous inter-linked processes. The systematic identification and management of the various processes employed within an organization, and particularly the interactions between such processes, may be referred to as the 'process approach' to management. The revised quality management system standards promote the adoption of a process approach when developing, implementing and improving a QMS. ISO Standards are based on just such a process approach, in line with the guiding quality management (25). ISO allows the nature of the organization's specific demands to determine how to apply the standards, but to perform activities within the process appropriate resources have to be allocated. A measurement system can be used to gather information and data to analyze process performance and input and output characteristics (52).

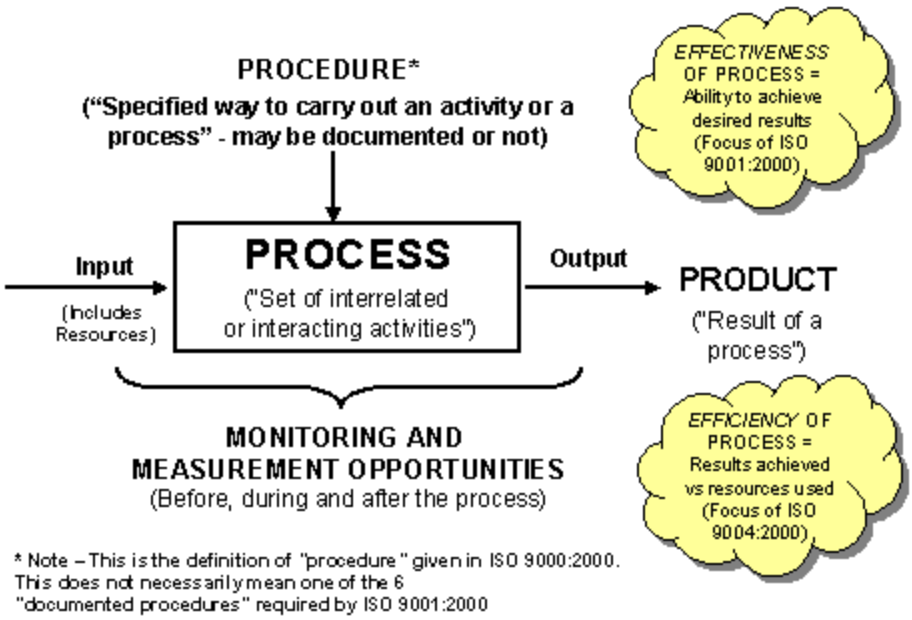


Figure 4. Schematic Representation of a Process, [From Ref. 48].

ISO 9001:2000 stresses the importance for an organization to identify, implement, manage and continually improve the effectiveness of the processes that are necessary for the quality management system, and to manage the interactions of these processes in order to achieve the organization's objectives. ISO 9004:2000 focuses on performance

improvements and guides the organization beyond the requirements of ISO 9001:2000. ISO 9004:2000 recommends an evaluation of the efficiency, as well as the effectiveness of the processes.

The Plan-Do-Check-Act (PDCA) cycle can be used to manage those processes. The "Plan-Do-Check-Act" cycle was first developed in the 1920's by Walter Shewhart, and was popularized later by W. Edwards Deming. For that reason it is often referred to as "The Deming Cycle." Extensive literature exists about the PDCA cycle thesis readers are encouraged to consult other literature for a deeper understanding of the concept beyond the following paragraphs the writer includes (28,31).

"Plan"	*establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies;*
"Do"	*implement the processes;*
"Check"	*monitor and measure processes and product against policies, objectives and requirements for the product and report the results;*
"Act"	*take actions to continually improve process performance;"*

Table 6. Table 6. P-D-C-A Defined, [From Ref. 25].

Within the context of a quality management system, the PDCA is a dynamic cycle that can be deployed within each of the organization's processes, and to the system of processes as a whole. It is intimately associated with the planning, implementation, control and continual improvement of both product realization and other quality management system processes. Maintaining and continually improving the process capability can be achieved by applying the PDCA concept at all levels within the organization. This applies equally to high-level strategic processes, such as quality management system planning, or management review, and to simple operational activities carried out as a part of product realization processes. The Note in Clause 0.2 of ISO 9001:2000 explains that the PDCA cycle applies to the QMS processes as follows (26,27):

- Plan-establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies

- Do-implement the processes
- Check-monitor and measure processes and product against policies, objectives and requirements for the product and report the results
- Act-take actions to continually improve process performance

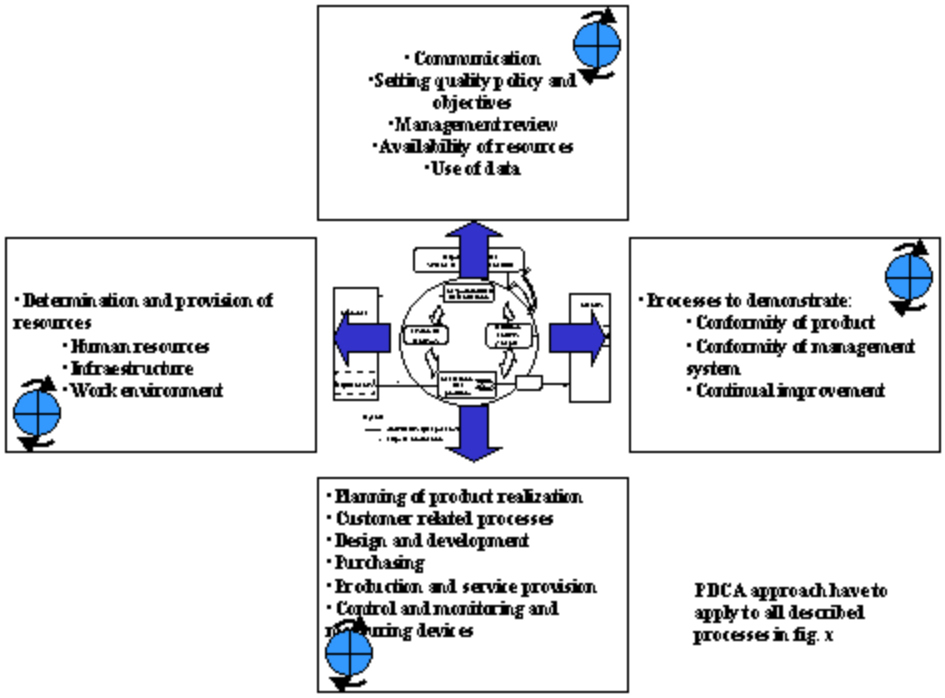


Figure 5. The "PDCA" Approach, [From Ref. 28].

A second important quality management principle that is intimately linked with the Process Approach is the System Approach to Management, which states that "Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives." Within this context, the quality management system comprises a number of interrelated processes. The processes needed for the quality management system include not only the product realization processes (those that directly contribute to making the product or delivering the service), but also numerous management, monitoring and measurement processes, such as resource management, communication, internal auditing, management review, and other processes (15). This can be seen schematically in Figure 3, which provides

greater detail of the kind of processes that typically comprise the quality management system, divided among clauses 4 - 8 of ISO 9001:2000 and ISO 9004:2000.

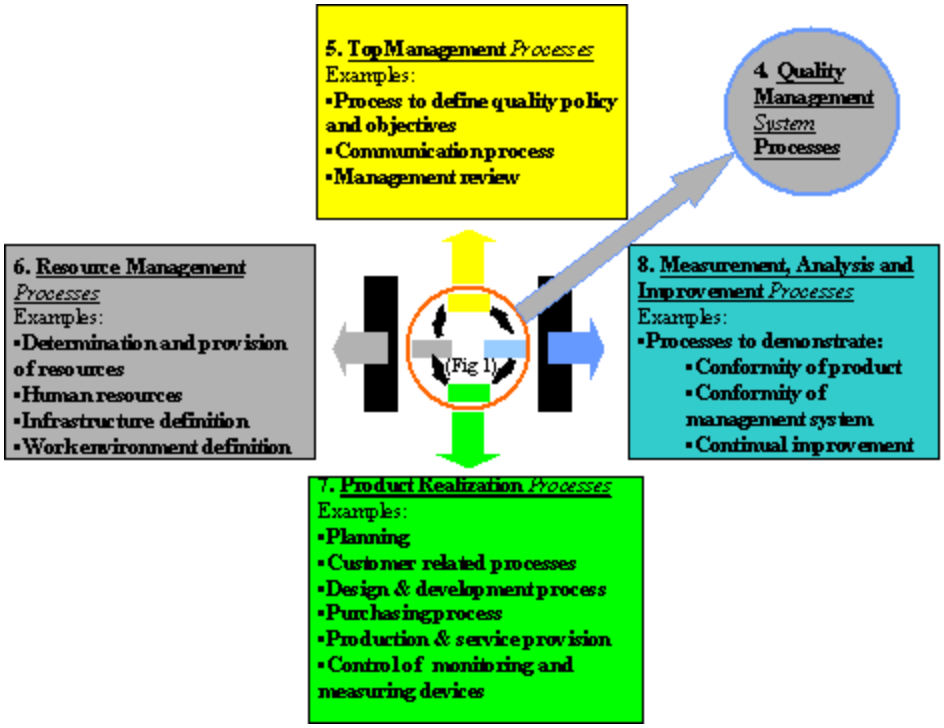


Figure 6. Schematic Representation of Typical Quality Management System Processes, related to Figure 3. [From Ref. 28].

Individual processes rarely occur in isolation. Outputs from one process typically form part of the inputs into subsequent processes, as shown in Figure 4 (25).

Figure 7. Chain of Interrelated Processes, [From Ref. 28].

"Continual improvement" requires an organization to focus on continually increasing the effectiveness and/or efficiency of its processes, to fulfill its policies and objectives. Continual improvement (where "continual" highlights that an improvement process requires progressive consolidation steps) responds to the growing needs and

expectations of customers and ensures a dynamic evolution of the quality management system (25,28). While the “continual improvement” concept of revised ISO 9001 is intended to promote the effectiveness of the quality management system, the revised ISO 9004 is intended to improve the efficiency of the organization. Together they will help increase organization’s competitive advantage in the market, and enable them to better respond to its customer’s requirements (28).

The consistency of the two standards helps organizations that wish to go beyond ISO 9001 to follow the guidance given in ISO 9004. An enhanced requirement for “continual improvement” has been introduced into ISO 9001, defining a complete cycle to improve the effectiveness of the quality management system (48). Continual improvement is a process of increasing the effectiveness of your organization to fulfill your quality policy and your quality objectives. ISO 9001:2000 requires that you plan and manage the processes necessary for the continual improvement of your quality management system (52). Continual improvement is not an easy concept to measure. Specifically in cases where product maturity has reached a high level or in many service oriented purchases.

A new item that has been introduced into ISO 9001:2000 is the requirement for the organization to monitor information on customer satisfaction as a measure of system performance (48)."Customer satisfaction" is recognized as one of the driving criteria for any organization. In order to evaluate if the product meets customer needs and expectations, it is necessary to monitor the extent of customer satisfaction. Improvements can be made by taking action to address any identified issues and concerns (28,48).

APPENDIX G. ISO 9000:2000 RE-STRUCTURE

A. BENEFITS AND IMPROVEMENTS

ISO states a number of major benefits are associated with the revised quality management systems standards. Among them are (31):

- Applicability to all product categories, in all sectors and to all sizes of organizations
- Simple to use, clear in language, readily translatable, and easily understandable
- Significant reduction in the amount of required documentation
- Connection of quality management systems to organizational processes
- Provision of a natural move towards improved organizational performance
- Greater orientation toward continual improvement and customer satisfaction
- Compatibility with other management systems such as ISO 14000
- Provision of a consistent basis to address the needs and interests of organizations in specific sectors (e.g., medical devices, telecommunications, automotive, etc)
- The concept of the consistent pair - ISO 9001 covering the requirements and ISO 9004 for going beyond the requirements in order to further improve the performance of the organization
- Consideration of the needs of and benefits to all interested parties

Main changes in the revised ISO 9000 standards are the increased focus on top management commitment, emphasis on the process approach within the organization, continual improvement together with enhancing satisfaction for customers and other interested parties (48). The main changes and new requirements that have been introduced in the consistent pair (ISO 9001:2000 and ISO 9004:2000) of quality management system standards are:

The main changes (25):

- A new process-oriented structure and a more logical sequence of the contents
- A continual improvement process as an important step to enhance the quality management system

- Increased emphasis on the role of top management, which includes its commitment to the development and improvement of the quality management system, consideration of legal and regulatory requirements, and establishment of measurable objectives at relevant functions and levels
- The concept of "Application" of the standard has been introduced (in clause 1.2) as a way to cope with the wide spectrum of organizations and activities
- A requirement for the organization to monitor information on customer satisfaction as a measure of system performance
- Significant reduction in the amount of required documentation
- Terminology changes/improvements for easier interpretation
- Increased compatibility with the environmental management system standard ISO 14001
- Specific reference to quality management principles.
- Consideration of the benefits and needs of all interested parties
- Addition of the concept of organizational self-assessment as a driver for improvement (ISO 9004:2000)

The main new requirements include (25):

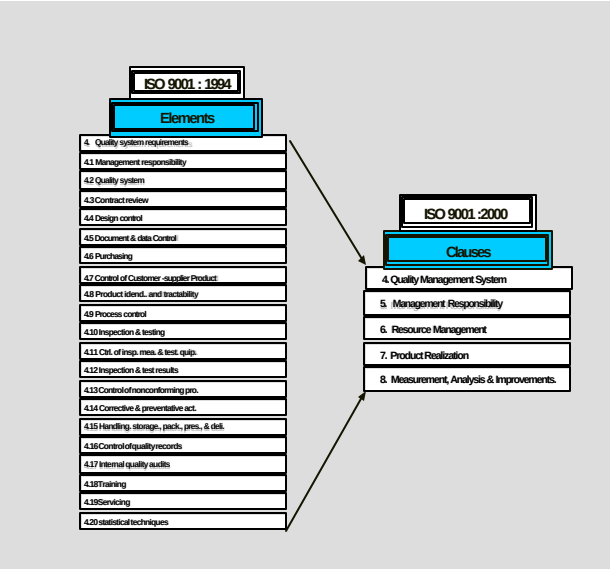
- Continual improvement
- Increased emphasis on the role of top management
- Consideration of statutory and regulatory requirements
- Establishment of measurable objectives at relevant functions and levels
- Monitoring of information on customer satisfaction as a measure of system performance
- Increased attention to resource availability.
- Determination of training effectiveness
- Measurements extended to system, processes, and product
- Analysis of collected data on the performance of the quality management system

The primary aim of the "consistent pair" is to relate modern quality management to the actual processes and activities of an organization, including the promotion of continual improvement and enhancement of customer satisfaction (48).

B. ISO 9000:2000 CLAUSES

ISO 9001 is organized under eight sections. The sections are organized into eight standard clauses. They are:

- **Section 1 – Scope**
- **Section 2 - Normative Reference**
- **Section 3 - Terms and Definitions**
- **Section 4 - Quality Management System**
- **Section 5 - Management Responsibility**
- **Section 6 - Resource Management**
- **Section 7 - Product Realization**
- **Section 8 - Measurement, Analysis, and Improvement**Of the eight clause of the new standard, Sections four through eight are the most important to the QMS. These clauses actually comprise the "heart" of quality management system. Each one of these five main clauses has a number of sub clauses which support the concept identified in the main clause (32).



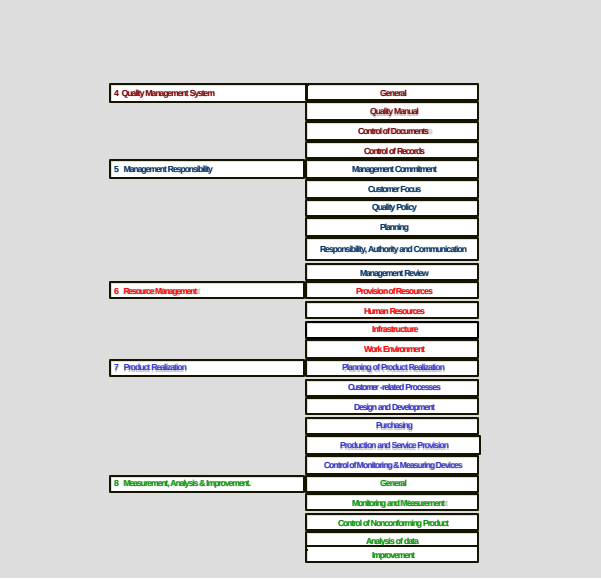


Figure 8. Clause to Element Cross Reference, [From Ref. 33].

Elements, clauses, requirements are similar words used in much of the literature produced on the new standard, but they basically mean the same thing, areas to be addressed. All of the element requirements found in the "1994" standard are reflected in the "2000." This does not mean that you will find a "word for word" transfer of the requirement to the new standard. What this means is that the "concept" that was covered has been retained, but not necessarily in the same form that was reflected in the 1994 standard document. Please refer to Appendix B (ISO to MIL-Q Cross Reference).

C. DOCUMENTATION

Whole or entire re-structuring of an organization's quality system or re-writing all procedures is not expected; however, the revised standards include some new requirements that will need addressing in a quality system. The three year 'transition' period allows accredited certification to the 1994 standards and ISO 9001:2000 to continue to coexist. This 'transition period' will end on 15 December 2003. By that date, all organizations wishing to retain accredited certification will have to have migrated their quality management system to being compliant with ISO 9001:2000 (25).

Basically two types of documentation exist. Those that tell us what to do and those that tell others what you have done (31). If an organizations current quality management system is successfully implemented, satisfies the needs and objectives of the organization, reflects the way the organization works, addresses all of the new

requirements, no changes are required. However, if the current documented system does not address all of the new requirements, additional documentation may be necessary. The International Standard ISO 9001:2000 has clarified the need for required documentation. Only 5 documented procedures, ISO 9001:2000 Clause 4.2.1, are required by the standards for administration of the system; however, other documented procedures may be required by your organization in order to manage the processes, which are necessary for the effective operation of the quality management system. This will clearly vary depending on the size of the organization, the kind of activities in which it is involved and their complexity (25). The quality management system documentation includes (31,48).

- Documented statements of a quality policy and quality objectives
- Quality manual
- Documented procedures required by this International Standard
- Documents required by the organization to ensure the effective planning, operation and control of its processes
- Records required by this International Standard

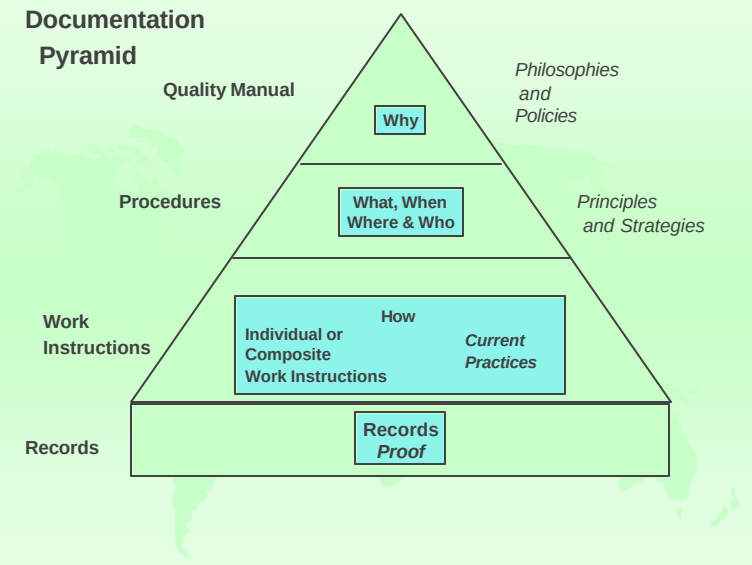


Figure 9. Documentation Pyramid, [From Ref. 33].

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX H. INTERVIEWS

A. INTRODUCTION

The information presented in this study was gathered through a sampling of 15 managers, directors, or auditors of quality assurance management departments from companies that are currently ISO 9000:1994 registered and the DCMA. The private organizations were selected based on their prominent role in the defense industrial base. DCMA representation was selected based on their lead role in organizing and distributing guidance and training on ISO 9000 and expert knowledge of military quality assurance and management. The aggregate list of respondents is presented in Appendix A.

B. INDUSTRY INTERVIEW RESPONSES

1. Question One (ISO 9000:2000 Registration)

Are you currently a registered ISO 9000 organization, and if so, for how long?

a. Discussion

The purpose of this question was to understand the background of the interviewee and the organization as it pertains to ISO Registration.

b. Response

All of the interviewees were currently or had in the past been part of ISO 9000:1994 registration and with DCMA Audits. One interviewee's current department is not ISO registered but maintains a MIL-Q 9858 QMS.

2. Question 2 (ISO 9000:2000 Registration)

Is the selection of sub-contractors biased to those registered ISO 9000 compliant and will you require those suppliers to become ISO 9000:2000 registered?

a. Discussion

This question was asked to query industry on its supplier or sub-contractor base in an attempt to explore industry ability to qualify suppliers or vendors QMS.

b. Reponses

- No, our customers require that we have a small Disadvantaged businesses program (based on a percentage of contract dollars) for procurement of supplies and services. Many of these suppliers are family owned and run businesses. The imposition of the ISO registration process on these suppliers could cause financial/technical barriers on them. To alleviate the problem we perform audits to insure that the supplier has sufficient control in-place to insure that product provided to GDLS meets or exceed our customer's requirements.
- 90% of our suppliers are ISO 9000 registered. In order for our suppliers to maintain their registered status with their registrar they must be ISO 9001:2000 by the end of 2003. The internal planning and change process to evolve to the new standard is very comprehensive and driving the requirement before the mandatory transition process is required would drive cost into programs that are being squeezed on a yearly basis for cost reductions by our customers. Not one of our customers is willing to pay more today for improvements even with the promise of future gains. With the current 2 to 3 year cycle of Program Managers assignments this is unlikely to change in the future.
- Registered suppliers avoid some of the obstacles required to become part of approved supplier base, however, registration is not a pre-requisite.
- No, it is not biased in that direction. Our processes and procedures allow for acceptance of a supplier based on the systems and processes in place that will allow for control of the material manufactured for our customers and us. In the meantime, the current plan is to move those suppliers currently on our Approved Supplier List (ASL), as well as those who wish to do business with us, towards process control and system administration very similar to that found in the QS 9000 standard.
- We perform a supplier assessment based on ISO 9000 but do not require formal (3rd party) registration. Although our registration is now to the 2000 version, our supplier assessment will continue being performed to the 1994 revision until approximately 2003.
- Yes and no, if they are ISO registered we may not conduct a self-survey or not as stringent of a survey, that is the advantage to the supplier and us. We still deal with many MIL-Q and MIL-I companies that have not converted to ISO so we may still need to conduct other survey methods. Unless the purchase order requires it we will not.
- We have established an advance quality system with our suppliers based on ISO 9000 and then they are told to comply with the system. We do not require they receive 3d Party registration. We will conduct a 2d party review. Past performance plays the critical role in our supplier base.

- No we do not require ISO we do encourage it. We evaluate their quality system approach. We look at the quality manual and quality system, past performance is a big part of it. We do not stipulate ISO. The advantage to an ISO registered organization is we may and often due reduce or eliminate our periodic inspection of a supplier.
- We have no bias towards organizations that are not ISO. If they are we may waive some of our inspections and surveillance but much of that depends on past performance and the status of the supplier.
- Our company uses a Quality Approach Supplier Relationship. It is rigorous quality assurance approach. A Quality System Review is used to identify potential suppliers to ensure the potential supplier has in place appropriate controls to meet Motorola standards. We do not mandate suppliers use ISO or become ISO certified since our own quality assurance provides greater detail and insight into a supplier. ISO does provide some benefits but the quality evaluation is based more on our relationship with the supplier, past performance, length, and fulfillment of previous contracts.

3. Question 3 (ISO 9000:2000 Registration)

What planning or guidance is your organization conducting to meet the ISO 9000:2000 certification and what are the significant changes it imposes upon your organization's quality assurance/management program?

a. Discussion

This question was designed to understand the planning and guidance organizations are using to meet the new standard requirements. The question effort was to gain a better understanding of any common themes or issues reoccurring between various industries as they plan and execute ISO 9000:2000 implementation.

b. Responses

- We are currently reviewing the standard and will implement according to the guidelines and timelines laid out by our registrar. There are no identified significant changes that we will need to address as a result of registration to the new standards, although we will be taking advantage of the opportunity to more fully map our processes and change our work instruction and procedure formats. If we find that there is more significant impact to our company we will find the necessary support to secure standard realization…
- We established a 9K2K (IS0 9001:2000) transition team in December 2000, with representative members from each facility throughout the company. This team was given various forms of formal 9K2K training

and subsequently developed our corporate ISO 9K2K transition plan. The teams major transition compliance activities can be summarized in 3 categories:

- o Re-write the Quality Manual.
- o Perform documentation gap analysis and revise procedures/instructions as needed.
- o Develop & Rollout employee awareness and delta training.

- Because of (what we believe to be) a very robust implementation to the previous 1994 standard, our gap assessments indicated that our management system was already in compliance with the 2000 requirements. However, making some modifications to existing Instructions to facilitate the availability of Objective Verifiable Evidence for some of the new requirements (e.g., Documentation of measurable improvements) needed to be made. Additionally, significant effort needed to be expended in mapping our existing documentation to the requirements of the 2000 standard.

- Yes we are moving towards 2K (ISO 9001:2000) registration, we are neither encourage or discouraged from DoD to make the conversion or to push our suppliers to convert. There is no significant or radical changes or costs we need to make with our current system to meet the 2K requirements. I do see it as a big change when you compare the 94 versions to the 2000 version. For me to explain how I see the change let me provide a brief history of ISO as I see it. The 87 ISO emerged from the European Common Market and used ANSI, MIL-Q, British Standards, and ASMI Code. So there was nothing new about ISO. What was unique about ISO was the registration process. It was used as a barrier for entry into the common market. The registration framework makes it successful and perpetuates the success, financially, of the companies that are registrars. It is a product or service the registrars provide for sale. ISO is a commercial product, not a significant customer support.

- Our transition is at two levels at the enterprise and the business unit level. The company is developing an overall enterprise 2k-transition plan, but each business unit has their own implementation plan. We have many units at 2k compliant already. We are taking the lessons learned and corrective actions they have made to conduct our transition to 2k. Our focus in preparing for the transition is on our business units processes looks at the corrective actions taken at other business units and to conduct on-going improvements to our processes.

- Our transition plan is to meet the requirements by April 2003. We will seek a joint registration between two plants. We will focus our plan on what we see are the significant changes in customer satisfaction measurement, document our continuous improvement process, and update our quality manuals. We are looking at the measurement and analysis of

our critical processes and goals connecting them to objectives and targets for improvement and then continually monitoring that process to continue to improve.

- I see the ISO changes as significant. A heavy emphasis on continuous improvement, management oversight, record meeting. It places more a burden on contractors to document their continuous process improvement. I disagree that the five disciplines talked to in the new ISO were already built into the previous 20 elements. The IOS provide little guidance on how to evaluate the new requirements. What is the right process to evaluate continuous improvement? Looking from the quality systems perspective and implementing 6 Sigma, training, and resources in all the departments across an organization. ISO focuses on how to implement and integrate all those processes across you organization. The 20 elements are those things that focus on product quality and you cannot do with out. The new version includes those but addresses them towards a global implementation.

4. Question 4 (ISO 9000:2000 Registration)

Do you believe the costs (financial and time invested) associated with becoming ISO 9000:2000 registered beneficial (more profitable and better quality product) for your company and your customer (DoD and other)?

a. Discussion

The cost of registration and its benefits are an obvious start point to discuss the benefits, if any, ISO 9000. The researchers interest was to focus the value added to the organization, as it would compare to an organization implementing its own unique QMS or the MIL-Q standards.

b. Responses

- I believe that the implementation of ISO led us down the current path that is in place and that has resulted in our company being more competitive and profitable than had we not achieved ISO certification. That said, I believe that the Management at my company is committed to continuous improvement and providing the highest quality product in the marketplace while fulfilling and exceeding the expectations of our shareholders. This would be true regardless of the Quality system we have in place.
- Having previously been a Mil-Q-9858 company, the cost trade off between ISO registration activities (including internal audits and other internal efforts) was equally counterbalanced with the absence of frequent Government/customer quality system evaluations.

- Unfortunately there seems to be a growing desire on the part of our (non-Government) customers to perform their own Quality Management System audits, irrespective of the fact that an accredited 3rd party registers us. These audits are causing us to evaluate the benefit/savings of being registered.
- The largest advantage that we experienced with the ISO 9000 Standard (which ultimately translate to being more efficient thus more profitable) is the flexibility that we (the supplier) are afforded in making our own determination as to HOW the requirements will be accomplished. The legacy Mil-Standard was quite prescriptive in not just WHAT but also HOW requirements would be satisfied, removing most of the companies ability to be agile.
- ISO is not value added to our organization. It is more of a marketing tool than an improvement to our quality system. Our registrar's advice and surveillance have been of little use. Our business has in use a sophisticated and complex quality system and it would be very difficult for any registrar to provide a great deal of value towards our system.
- The most beneficial outcome of ISO is to have an outside registrar to validate the quality cultural changes that need to be made in our organization. It does not require the quality department, often thought as the quality police, to champion the change. The change required is organization wide. It is difficult for an organization to make quality changes internally. ISO helps us focus on our programs we want to establish a refocus on what we are doing (competencies). The 1994 ISO helped in our process focus moving from the previous MIL-Q. ISO provides a competitive advantage bit only short-term. Many organizations have known for decades what they needed to do but were unable internally to do so because of the culture. ISO provided the focus or catalyst for change.
- Yes and no, before ISO we had MIL-Q. There are some differences but there are many common requirements. ISO brought in some other standards like human resource management, contract review and internal audit process and how to deploy those resources properly in the organization. ISO expands your business and defines your activities that support ISO. The biggest benefit is the cultural change it can bring about. What we once thought as unrelated to quality is actually related. It effects the whole organization. Previously we looked at the downstream process ISO brings in the upstream processes that impact the product. Quality goes to management commitment, capable processes on the manufacturing floor. ISO can bring in the discipline to change. I see no significant costs to change to ISO 2000. They are asking for things already implied in the 1994 standard.
- A few years ago we conducted a cost analysis and breakout of ISO registration. The largest barrier was in training. The time it took to train

the workforce and the time it took away from their normal duties. ISO registration and preparing for it is very human resource intensive.

- The ISO quality assurance process to follow ensures some consistency, and offers an appropriate methodology to use. The ISO registration provides leverage as a sales marketing tool and to some a competitive advantage although ISO is becoming more prevalent across industry. The third-party registration of an unknown supplier does provide some benefit to the buyer that some baseline of a quality system exists in that potential suppliers organization. Some small businesses have difficulty in justifying the cost to get a third-party registration. Third party registration provides another benefit as well. Organizations often self assess with 'blinders' on; they think they are doing well but may not be. The third-party registration provides a baseline or benchmark to compare you to other organization and a standard or template that is industry accepted and proven to work by an "unbiased" independent party. The cost of our last registration, just the visit, was $25,000. This cost does not measure numerous other resources used for the registration.

5. Question 5 (ISO 9000:2000 Registration)

What are the major barriers in becoming ISO 9000 certified? Are there new barriers introduced by the 2000 version?

a. Discussion

This question's aim was to outline what impacts or obstacles implementing ISO 9000:2000 has contractually and against resources.

b. Responses

- The major barrier to become certified is having the required time for everyone to provide his or her input. Everyone in the organization has his or her normal job functions and finding the extra time can be difficult. I don't see any barriers in the new revision.
- For a defense contractor the 2000 version did not impose anything that we were not already doing. The added requirements required us to map those activities to our manual.
- The major barriers encountered at my business unit were associated with a new way of looking at Quality as a team, the "paradigm shift," if you will. The increased emphasis on management involvement for the latest standard will pose no significant difficulties.
- The initial barriers (I prefer the term challenges) to ISO 9000 certification are:

- An initial and significant effort in mapping or restructuring one's documentation system to align with the standard.
- An initial increase in the need for employee awareness training due to additional requirements (e.g., Familiarity with the Quality Policy, Knowing who the ISO management Rep is…) not previously thought to be necessary.
- Establishing the budget for training internal auditors and hiring a registrar.

- Added challenges related to the 2000 Standard:
  - Designing a system to capture evidence of improvement programs and upper management's involvement.
  - Re-calibration between us and our registrar regarding some of the new requirements and exactly what they mean. (Based on the 1987 to 1994 transition, the variation of interpretation reduces with time; but the initial differences in opinion starts out fairly wide)
  - The culture of us versus them, between the quality inspectors and production, is difficult to change. The culture change needed is the move to make everyone responsible for quality assurance in the organization resulting in a better product. Making each one focus on their processes in quality management so we don't have the performance and defect problems to begin with. The goal is to make sure all the various partners in our company take responsibility and accept their function for the quality of what they do whether it is a process or a product. This helps every one understand that quality is everyone's business.
- The major barrier is cost. Our organization has no management barrier. Our leader are versed in the quality control process exceeding ISO in many ways, like our 6 Sigma Manufacturing and Services.

6. Question 6. (Quality System and Quality Product)

One criticism of ISO 9000 registration is it provides no guarantee of product quality or conformity, only that a quality process is in place. Do you agree, disagree with this statement?

a. Discussion

This series of questions is based on the recent incidents of ISO 9000 registered organizations producing non-conforming and defective material. Its purpose was to elicit comments on some of the problems or misconceptions about ISO registration and what measures can be taken to increase quality control and product conformance.

b. Responses

- No registration process will guarantee product quality. The guarantee audit would be so expensive that it would be unaffordable, in addition, there are very few people that could perform an audit to the scope and detail required to verify every step in every process is acceptable. Even 100 percent inspection is only 85% effective.
- This is correct, however the nonconforming procedures and the corrective action procedures should be finding the nonconformance and corrects the deficiency.
- I agree. A great process must have discipline in place to achieve the desired results.
- This would be true of any quality standard. It is not nearly as difficult to achieve certification, as it is to implement the underlying concepts behind the process.
- I agree. ISO registration indicates that you have the minimum necessary business/management processes in place; it is the starting point for stellar quality not the zenith.
- If you really understand that quality is everyone's responsibility. If you understand the essence of the processes and that is what Process Based Management helps you to do. The fact that everyone is looking at their processes through established metrics, and measuring the process against the metrics, you would be hard pressed to have a major systems failure. I see the problem not with the registration process. A company may not have bought into the quality process they were registered against. I am speaking again of culture. You can put the quality system in place, get registered, but if you are not conducting the process management or if everyone is not taking responsibility for the established process you will have problems.
- It comes down to the management philosophy of why you are doing this. You can fool the auditors but if you use them as a tool to improve your process you can use that information to make real improvements with your company. People of the organization must embrace the need for their role in the quality process of the whole organization and its product. Key is to understand why we are changing the culture. It is a company generational change. What I like about ISO is how it grows with the evolution of quality standards and shifting culture over time. We take it in phases. It helps us evolve, our culture, management, and people.
- I agree, no matter what system you use you could be making good scrap. The 2000 standard says you have to have measurable targets or objectives linked to continual improvement. An organization's policy objectives, cumulative resources, and capable processes along with ISO result in

quality. There is no quality guarantee with mere compliance to ISO. ISO provides a disciplined approach to maintain you system.

- If you use the analogy of a car air bag to that of a quality system like ISO or MIL-Q, statistically you may never use a car air bag but the time you do you are glad you have it. A quality system provides that check and balance for the time when a quality issue or product default presents itself, thus reducing the times you create defective material. Quality addresses risk. Well-defined, well-implemented quality systems greatly increase the percent of time you have no defects. The quality system has parallels to airport security. No system can guarantee that no security breach will occur except one where no one would want to fly due to all of the constraints and restrictions. You want to have a system that provides the greatest return on quality to the cost of producing the product to that standard determined by the level of risk you are willing to assume. You want to get your highest return on the cost of the process, control measures, and organizational resources you place on a quality system.
- ISO 9000 is just an audit of your quality process providing a registration that an organization is meeting or following a quality system in place, not necessarily if the process is being properly implemented. To some degree ISO provides product quality assurance but there are other intangibles: warranty, consistency, quest for quality, process tools to continually improve, cost analysis, and product process quality issues and resolution. No organization is free from quality product issues. There are always concerns with suppliers, safety, etc. The critical part is the feedback loop and internal and external to our company to provide quality products.

c. Question 6a

Is it possible for any preaward survey of quality assurance to detect indicators of a sub-standard product or service?

- Yes, remember that the ISO 9001:2000 standard is a Quality Management System. You also need to know that there were many debates about taking the "Quality" out of the title during the development process.
- No, on a small insignificant matter. Yes, if the system has a major breakdown.
- No, a preaward survey will only indicate the presence of capability, and will not provide assurance of the actual product/service quality
- The preaward survey can provide a companies core competencies and capabilities. It can detect a critically sub-standard quality. Will it detect a potential bad product or service? I say it depends on the qualifications, skills, and insights of the auditors more than any survey or checklist. DCMA, at best looks at an organization in-house, for two days for a preaward survey, it can only provide a good basic feel.

d. Question 6b

What guarantees does ISO 9000 certification provide towards a quality achieving organization resulting in a quality product?

- The certification is not the key internal process management and controls. The management system including internal audits are key to an organization achieving a quality product. We have averaged about .5 minor nonconformances across all of our facilities and all audits since 1997.
- Any organization can put together a system that can attain registration; the key is the desire to perform at half throttle or at full throttle. The greater the effort is, the greater the return.
- None, I do not believe that ISO 9000 is a guarantees quality; rather it is the single best indicator of the ability to produce a quality product.
- ISO procedures are not intuitive and are not directly related to the product. ISO procedures do not yield a product; good procedures or good requirements do not necessarily yield a good product. It is more directly related to the process. We have systems audits, business controls, ISO, manufacturing techniques, SPC, etc. The degree of compliance is measured. Do we have perfect compliance to our process procedures, and if we do have perfect compliance then do we have a good product. For example, do we have a good operation but the patent dies. The true test of process procedures is not if they meet some artificial requirement like ISO. The test is, "Does the product work!" If you have processes and procedures that produce good product then you have something. You then establish those procedures in writing and then train to them and measure them. The existing procedures become experience retention in your workforce. Experience retention and experience culture make a good organization. This experience is put back into your continuous process improvement and control.

e. Question 6c

What value added does the ISO Registration have?

- A second set of eyes, a regularly scheduled review that forces you to put things in order twice a year. And the cost is a management commitment to support the management system.
- Our registration helps to maintain our customers' confidence and that of the public.
- It sets a direction that is up to the team who implemented and achieved the certification to understand, and allows for the base lining of improvements achieved through continuous improvement efforts.

- When recognized by the customer, ISO registration eliminates the need for customer assessments; yielding instead to certified 3rd party audits. This is a saving to the customer and to the contractor in that a single registration audit can eliminate multiple customers performing similar duplicated assessments.
- An ISO 9000 registration is commonly understood across the industry. Where in the past a thesis was expected to articulate your quality system; now simply showing ISO registration is understood and accepted. I equate ISO 9000 registration to a college education. In the same sense that a college degree neither means that the graduate is 'smart' nor does it mean that the graduate can function as an experienced practitioner in his/her field; the education does demonstrate that the student has successfully demonstrated the ability to learn and possesses the basic understanding of elements of the field that he/she has studied.
- Similarly, ISO 9000 does not mean that a company produces a great product; but has demonstrated that it possesses all of the basic processes deemed necessary in order to produce a quality product/service.
- The value added is the industry wide recognition of the standard.

7. Question 7. (Quality System and Quality Product)

What quality assurance/management measures do you take to insure your own process and that of your suppliers demonstrates product conformity and/or critical characteristics, in terms of defect levels, are acceptable; and that improvements are planned and later demonstrated?

a. Discussion

This question was asked to generate responses to address issues raised in the previous question on how to address quality assurance above and in addition to ISO.

b. Responses

- We use trend analysis to show improvements.
- We have a broad range of measurements from sampling, SPC 100% inspection, etc.
- Internal and external audits are the most common means of system and process validation, although a sampling of material is also a must. We also monitor material at all phases of manufacture and note any deficiencies and associate those deficiencies with a responsible party through root cause analysis. Corrective actions are reviewed and accepted and validated in each case where failure has occurred.

- Product evaluations are the major "added" activity to those already addressed by the ISO standard which ensure product conformity, critical/key characteristic compliance and that the deliverable product is a quality item.
- We use many tools, SPC, ISO as a baseline in some areas, varying trend analysis etc. The key to success is management's ability to know when to use the right tool.
- We have advanced quality procedures levied against our suppliers. They focus in three areas, variability control, hardware quality audits, and ISO process management approach. Internally we have a constant source of metrics that we manage with DCMA, internal management, suppliers and each business function. We have transitioned the metrics from a product focus where we tracked results and defects to more up front in the process measuring something that will not allow us to have the defect.
- We use our supplier evaluation selection process. It measures and monitors suppliers processes and controls, involves a supplier rating system and provides procurement quality assurance. It monitors our suppliers through on-site inspection and upon receiving a product. The evaluation or rate dictates the amount of surveillance and oversight we use.
- Other measures have been in developing a supplier corrective action system where we have partnered with our suppliers to develop a better quality product. We have reduced our supplier base to gain better control and we hold an annual supplier symposium over three days to discuss future business plans and operations.
- In-house we use non-compliance control corrective action. We have quality improvement boards for nearly every business function and unit. These boards use the experience and information from the people actually implementing the process to make improvements. Information and improvements from our quality improvement boards that meet weekly and our quality improvement council that meets quarterly involve all stakeholders to improve our organizations quality improvement process.
- The key is to have a flexible and dynamic system, whether it is ISO or MIL-Q, that responds to the conditions at hand. The system needs a list of menu options or courses of action to follow to implement to distinguish between a trend and an isolated incident with a vendor.
- We have many pre-ship quality processes. Most are based on the CMM Model and follow CMI and our Standard Processes. We have a process that looks at and measure the critical paths of a product; design, build, manufacturing, test and function, focusing on the products "critical characteristics." We also use break and fix, accelerated life testing to mature our products to measure quality level.

- On the production and service side we have numerous management review, various avenues for customer feedback, tracking systems like systems defect trends. All of these procedures are linked to our organization's Failure Review Board involving all product players (stakeholders). Suppliers and customers are a part of the entire process and manufacturing relationship. An output is our Quality System Report Card providing our process to improve.

8. Question 8. (Quality System and Quality Product)

Have the problems, shortcomings, and lessons learned with the previous ISO 9000 standards and registration been addressed under ISO 9000:2000 and have the latest technologies and best business practices been introduced into the new ISO standard? If not, what are your recommendations on what should be addressed and introduced?

a. Discussion

This question was used to allow organizations to provide the researcher with insight into what quality assurance practitioners saw as the strengths, weaknesses, and opportunities of both ISO 9000:1994 and 2000 provide.

b. Responses

- They did a great job. Could there be improvements? Always! Getting consensus from 100 countries and thousands of representatives is near impossible. Let the evolution to this standard happen, I think we will find that the Registrars and Companies will incorporate the standard in the spirit of it's intent
- The document (ISO 9000:2000) is biased towards the supplier and what it takes to meet the document. Suppliers have the most influence on the document. It is tailored for them. What are the buyers risk when they purchase something? The buyer community has not been addressed in the 2000 version. The customers of the registrars influenced ISO 2000. I see it as a less effective document and aimed more towards the service industry rather than manufacturing.
- No, our requirements always have and always will be more stringent than commercial industry, not to mention we have our customer living within our facility.
- In my opinion, the new standard has complicated process. The new standard will create a reduction in registration of small companies (500 or less) due to the additional requirements, which will increase business cost.
- I do not believe a standard should dictate technologies and business practices but rather should provide a framework for Management to

determine what works best for the particular product manufactured and sold. The previous ISO standard built the foundation, and it was ample. The latest revisions appear to require added management involvement and recognize the cross-functional requirements that are necessary in an optimally running company. What has occurred in my eyes is the standard has grown to better reflect the current business environment.

- The only improvement that I see in the 2000 version is that it is restructured to eliminate the perception that ISO 9000 is 20 separate, stand alone elements that "the quality guy" is responsible to ensure are met. Unfortunately, a large degree of vagueness in the requirements of the standard accompanies the new revision.

- ISO 2000 is a significant and radical departure and move towards supplier ease of implementation as opposed to effectiveness as a customer tool. The new version is more concerned with producer risk than consumer risk. The ISO standard is neither good or bad, it is not a silver bullet of quality to an organization either. I would not give the ISO document to a new company to begin business. It is not a specification but more a course in general management. I see three new areas in ISO 2k, continuous process improvement, quality objectives, and customer satisfaction. While these are new to the document does it help be make better widgets? The whole focus of the three is nothing new any good business is doing these things already or they would not be or continue to be in business. The document forces customers to provide feedback. Why should ISO force feedback? Every time a customer returns to me they are providing feedback. An organization cannot remain in business if they do not receive feedback. The document should be intuitive for any competitive market in a capitalistic society. ISO provides no edge it is generic it wants everyone to be gray. It lends itself better to socialistic markets where competitive prices of the market place are not allowed to establish the market. Our markets (U.S) require organizations to have an edge or advantage to prosper. ISO provides only a baseline and should not be used to distinguish between what an organization is to use and how it will provide the best product or service. Do we want a level playing field of quality management? Should every one be on an equal basis or in a standard way? Our ISO registrar criticized the way we managed some areas stating it was not like everyone else did it or as the ISO document prescribes. My reply is, "Exactly that is what provides us an edge over our competitors and provides us more of a market share and/or return on investment." It is our quality management secret and strategic advantage; do not give it to other companies you registrar. I would not recommend that a company follow ISO and nothing else because it leaves them equal with every one else. Businesses succeed or fail on their ability to manage. There is no quality; quality management is an illusion invented by academics and registrars who want to create a discipline where one does not exist it is an

art. An organization and its people must be competent, capable, responsible, and accountable for doing the right thing.

- The major changes we see in the ISO 2k is its focus on process-based management. For our organization the program is to identify our critical processes, develop a plan, and use our seven-step process to evaluate the process and improve it through the monitoring process. Our seven-step process of development fits well into the ISO standard and its process based management approach. Through understanding your process and developing metrics around that process the measure how you are performing is how to continue improvement in the process. Previously ISO was a system that looked at content and processes based on a process now ISO focuses on process quality ownership.
- There are explicit and implied changes in the new ISO most are adapted from the process business management approach that asks for an organization to define its core competencies, relationships between each process, what the process flow is, and the criteria if capable or not. I see it failed to address much on safety. It does look at the work environment but many define that very narrowly.
- I do not see many shortcomings. What is obvious to some in the previous 20 elements is not so to others. What organizations see as shortcomings or weaknesses and even strengths of ISO is largely dependent on the culture of the organization implementing ISO. It is largely dependent on the level of importance and role culture plays in allowing the organization to understand ISO techniques of quality assurance and management resolution to champion the organizational change to the current culture.

9. Question 9. (Quality System and Quality Product)

Will ISO 9000:2000 emphases on customer focus, product realization and conformity, process management, and resource management address the past shortfalls associated with the 1994 ISO version?

a. Discussion

The question was designed as a follow up to the previous question to address the effectiveness of some of the new changes built into ISO 9000:2000.

b. Responses

- Yes, it will help to cause continuous improvement in those and other areas.
- No, I believe that the attempt to add these emphases added a greater lack of clarity. All of these 'elements' existed in the previous version.

- I have three main criticisms of the new ISO document. One is its focus on producer risk rather than customer risk. The first three section of the document (ISO 9001:2000) are confusing and unclear it is not until you get to section four that you find any substance. The dilution of the 20 elements into the new five area of quality management is a Harvard Business School course on how to manage, not a good quality system. The 1994 version provides a checklist of the basic fundamentals of management; however, in the 2000 version all of that is gone. The 1994 version provided a quick way, or a rough-cut or view, for customer auditors to evaluate suppliers. The new standard is deplorable because it is harder to determine what it is requiring.
- The previous 20 elements are now spread against the new five disciplines plays well into how key stakeholders in quality management development are reorganizing. It moves away from the stovepipe approach of organizations where one or some function was responsible for one or a series of the elements. ISO now spreads the previous 20 elements responsibility across the entire organization using the five disciplines. You cannot do away with the 20 elements; they are the basics, the premises of business. ISO did not invent a total new way of doing business; just new ways to better develop your own processes.
- My concern with the 2000 version is the customer satisfaction measurement as it applies to organizations that primarily deal with the DoD as a customer. Customer satisfaction is not an easy thing to measure when DoD is your customer. We have many customers, DCMA, DCAA, the buying command, the program office, the systems manager, and ultimately the soldier. ISO does not tell you how to do it just that some process needs to be in place to estimate it.

10. Question 10 (DoD and Contractor Quality Assurance Relationship)

Has ISO 9000 become the quality management standard for DoD contractors, i.e., must a contractor become ISO 9000 certified to conduct business with the DoD especially in contracts requiring a higher-level quality standard?

a. Discussion

The issue the researcher wanted to raise in this question is, although ISO is not mandated by any Federal procurement regulation and guidance, has the ISO influence created an environment in which industry must be compliant with ISO to conduct business.

b. Responses

- Not that I am aware of. Nor should it be. From a competitive standpoint the DoD should compete its contracts, as any good business would do. It should insure that the material it requires meets its requirements and that the place of manufacture is consistent in its performance. Some companies are quite capable without certification to meet any customer's standards and expectations. If all contractors were required to be ISO, would that eliminate those who are registered to other standards, QS 9000, for example? Being certified and maintaining that certification through semi-annual audits helps to mitigate risk to the customer, and the DoD is after all a customer. A company's commitment to high quality is not simply reflected in its registration. It is reflected in its workforce and product.

- What concerns me is the use of ISO 9000:2000 in contracts and to qualify my organization as a supplier under that standard, especially the measure and aspect of continuous process improvement and product realization. Those are both difficult to measure contractually. For example, lets say you manufacture bicycles and you have made bicycles for years. You initially improved from 90% to 95% then 95% to 99%. Know you are at the 99.99% you will have little, if any, improvement. Does that mean I failed to meet my contractual obligations? Will I be terminated for not improving my product? Improvement is a good thing but not an easy contractual element to accurately measure. The key is to provide motivation for the supplier to improve on the contract not to punish the supplier if they do not. Motivated suppliers to improve and provide good products. Contract risk is mitigated through the motivating the supplier through contract.

- Some would say yes, the way contracts, statements of work are written it has become a de facto requirement. Of course it is always dependent on the contract and what an organization is using the contract to purchase.

- No, it can be ISO or equivalent. MIL-Q, QS9000 that is more restrictive and prescriptive can also be used.

- No, in fact in November of 1999 we participated in a program to update MIL-Q 9858 checklist and be evaluated against the revised checklist. The reason DCMA wanted to revise the past checklist was the realization that many DoD contractors wanted to remain and still use the MIL-Q standards and did want to move to ISO. Many organizations were and continue to work well under the MIL-Q standards and could not justify the cost to switch to a new system. MIL-Q is more directives than ISO is but ISO contains many "shalls" and "wills".

11. Question 11. (DoD and Contractor Quality Assurance Relationship)

Should DoD impose ISO 9000 standards and registration on contractors and sub-contractors as an entrance to conducting business with the DoD?

a. Discussion

This question was meant to elicit general comments on the benefits and problems of a DoD mandate of ISO 9000.

b. Responses

- No, this puts a financial burden on small companies.
- All contractors have a system that meets or exceeds this due to the nature of our business after all ISO is an offspring of 9858. If the DOD were to impose registration then defense contractors would be able to bill the DOD for our ISO registration cost. This will not happen.
- Yes, but if 3rd party registration is imposed, DOD audits should be removed.
- In my opinion, DoD cannot use the blanket policy of choosing only ISO registered organizations to do business with. Commercial buyers and producers must be better than that (ISO). Selection must be process and skill determined and situation dependent. You want to use source inspection and performance data and feed that into a process of source selection. DCMA and DoD has not done a good job of doing that they have not invented the proper tools to use to make that process work as well as industry has. A good example of how this works is a vendor-rating program. Product is inspected; performance data is generated and processed into our vendor-rating program across the organization. We use it as a tool for future supplier selection. I see DCMA request the data but I don't see a documented transfer or process to provide the information across DoD organizations.
- In general terms no, but ISO has influences on all of these.
- Maybe, DoD should look at whether the standard meets what they are buying. Most contracts say ISO or equivalent, most of our international contracts specify ISO by name. With our international business we must have ISO.

12. Question 12. (DoD and Contractor Quality Assurance Relationship)

Some DoD Quality Assurance Representatives (QARs) complain some ISO registered companies believe that if they are ISO registered that only limited DoD inspection is required. Should DoD QARs accept ISO registration as certification for the

Preaward Quality Assurance Survey and has registration reduced and/or eliminated DoD on-site quality inspections or audits during the surveillance phase, should it?

a. Discussion

This question was posed to address one of the major problems associated between the DCMA, industry, and registrars of ISO. The questions goal was to bring into context the Third-party registrar and DCMA role in quality assurance audit and surveillance.

b. Responses

- I agree the Preawards could be eliminated, and yes the on site quality inspections should be reduced.
- The surveillance audits are quick passovers to check for system breakdowns. To fully evaluate a system as critical as ours requires detailed surveillance. We have a unique system in that our customer participates on our monthly Internal Audit Reviews thereby maintaining oversight without performing additional disruptive activity.
- Should DoD QARs accept ISO for the preaward? Since preaward implies no final selection has been made, yes. After a preaward is conducted (for example, a desk audit) and before signing contracts, it is always good business to visit the site and ascertain its true capabilities. That would be a pre-contracting audit and should be performed.
- Has ISO certification resulted in a reduction of on-site customer audit personnel? In our case, no. It should be, though. As a company matures into the ideals surrounding ISO and continuous improvement efforts prove to reduce the risk to the customer well below the noise level it would seem to be a waste of money to maintain large, on-site oversight personnel.
- The areas (or elements) assessed by the 3rd party should not be re-audited by DOD. However many DOD evaluations go beyond the ISO requirements. …DOD should evaluate the delta; otherwise an added burden has been placed on the contractor.
- I do not think it should be based on ISO registration. We should be able to prove to our customer the quality of the product. We should be able to conduct an adequate job of monitoring and continually improving the measurement of our process, whether or not we use ISO, MIL-Q or any other system, that should be their (DCMA) justification for backing off on the amount of oversight and surveillance. The system is not as important as how we measure up to our customer's expectations and requirements. It is a matter of trust based on data.
- The amount of surveillance or oversight should not be based on any redundancies found between registrars and DCMA but driven more by how well the process is working and measuring up to the oversight DCMA

feels they need to conduct and as to how we are evaluated to contractual performance measures. The relationship, if one exists, is if ISO has helped us improve and organize our process to a point to where DCMA is more confident, not the ISO registration. It is a matter of confidence and risk associated with the contract not a correlation of registrars and DCMA.

- I don't think ISO alone has reduced inspectional and oversight. I believe low-budgets, past-performance, fewer resources, ISO, and our good relationship with DCMA has reduced surveillance and inspection. PROCAS and our partnering with DoD have also reduced the amount but not ISO alone.
- There are differences among registrars and differences among DCMA auditors. Government representatives come from different agencies, from various areas and communities, with varying objectives against the same contract. DoD agencies waste time with the infighting that occurs between the various DoD stakeholders. It constrains DCMA and all the other DoD agencies to adequately evaluate an organization because DoD cannot reach consensus on what they expect of the contractor performance against the contract. The roles of contract administration are not agreed upon between DCMA and the buyer.
- The PCO and ACO must clearly designated and define the areas of contract administration and procurement functions. The resident DCMA representatives should take the lead in deciding the jurisdiction of the PCO and the ACO in many of these matters.

13. Question 13. (DoD and Contractor Quality Assurance Relationship)

How should the preaward survey and the follow-on quality surveillance of DoD QARs be conducted (consider training, DoD culture changes, and in-plant conduct)?

a. Discussion

This question was asked as a follow up to the previous question to solicit comments on how best, in industries' view, to address issues raised in Question 11.

b. Responses

- If there is a preaward focus on the performance spec of the product not the quality system. QARs should be invited to the management review meetings to understand how the quality system is performing and this would be an opportunity to provide customer input.
- You establish the expectations before award. Validate a firm understanding of how you, as the customer, expect things to be done. Validate that those materials being purchased can be assembled or manufactured IAW the requirements. Validate the beginning of production through thorough audits of the processes. Then establish the

plan for follow on visits, while letting the supplier know that any issues that arise will bring your group in as a reactionary force to assist with issue resolution. While this relationship is being established, you must also express that you have a shared interest in the success of the program and are willing to do whatever is necessary to insure that success.

- I see no change in the procurement assessment process other than using (and not duplicating) the ISO registration as an accredited certificate that the Quality Management System is acceptable. This should not affect other parameters of pre/post award assessment of suppliers.
- It depends on how DoD chooses to use DCMA. DCMA are not registrars and registrars are not DCMA. Registrars are system oriented and conduct a paper work audit where DCMA is more hardware or product oriented and conduct audits to that degree. Both organizations depend a great degree on the skills and knowledge of the person and not so much the organizations mandate. It is difficult to find people with both the skills and ability to look at both systems approach and the process and product approach results.
- The preaward survey is adequate for its intended use. DoD agencies must cooperate better to make the system work more effectively.

14. Question 14. (DoD and Contractor Quality Assurance Relationship)

In your view has the DoD culture and approach changed in quality assurance audit procedures under accepting 'most effective quality system' instead of MIL-Q-9858?

a. Discussion

The culture of DCMA from an industry viewpoint is addressed in answering this question. The question was to gain perspective on outsiders' view of DCMA culture and attitudes effecting MIL-Q to ISO change.

b. Reponses

- The QARs appear to have not changed at all.
- Yes, overall the transition by DOD to the "industry standard" philosophy is in place.
- Our relationship with DCMA is better now than it has been in the past. The process improvements have been good. But as DCMA reduced their personnel by two-thirds over the past decade all you had left was older, more senior employees. These employees come from a past culture of inspection and monitoring that we (DCMA) cannot trust the contractor. You reach a point where it is very difficult for DCMA to change the culture. It is a generational issue. They (DCMA) are being taught, trained and told to do it differently but can't or won't change due to the past

cultural influence. The environment has become increasingly more technical with change occurring more rapidly than in the past. With the high cut-backs in personnel and few new people it is difficult for DCMA to attract new people with the qualifications and skills required to adequately evaluate an organization from a systems and technical approach.

- The change is for the better. The culture is focusing more to the processes associated with quality than the end result inspections of the past.

15. Question 15. (DoD and Contractor Quality Assurance Relationship)

How effective (strength and weaknesses) is the quality assurance/management audit and later surveillance performed by ISO Registrars and DCMA or DCAA Quality Assurance Representatives?

a. Discussion

This question focused on the audit procedures, rather than the auditors, and the audits strengths and weaknesses.

b. Responses

- The ISO registrars are reviewing the system every six months; this frequency is greater than the QARs review. My opinion is the QARs would wait for a nonconformance to occur and then review a process, which is to late. The ISO registrars are more proactive.
- Not nearly as effective as our own internal reviews. They lack the understanding of the processes and cannot therefore adequately judge them. They are not intended to identify all issues. (DCMA) audit can and should only be cursory in nature. The supplier must earn trust. (Supplier trust)… provides the confidence necessary to the customer. It is the supplier's responsibility to prove that risk is minimal and good value is being delivered in each case. The systems, which are implemented, to comply with ISO are but one step in creating that assurance.
- Our DCMA auditors perform joint audits with us, as a single team. I believe that the DCMA participation in this effort is strong.
- The registrars are head-and-shoulder above DCMA on their ability to evaluate compliance to the ISO Standard. They (ISO) are much more capable to understand the systems evaluation of an organization and the organizations' written procedures to match the system. Registrars look at the entire business system. Registrars are not very good at looking at a product and measuring its conformity and compliance to the procedures. DCMA is hardware oriented and much more familiar with the hard ware requirements.

- The biggest disconnect is between the DCMA and the system user. More needs to be done by DCMA to better understand and determine what the user is looking for. This places the contractor as the3d party police officer between the DCMA and the user. The DCMA lacks insight from the user and the user's requirements and how to meet the user's expectations.

16. Question 16. (DoD and Contractor Quality Assurance Relationship)

What changes in training should DoD make to better address ISO 9000:2000 and better address the quality assurance needs of industry and DoD customer demands?

a. Discussion

This question was meant to solicit input from industry on how best to train DCMA representatives conducting quality assurance auditing and surveillance.

b. Responses

- Provide training to the QARs for the new standard
- I think the DoD made the correct decision when they decided to get out of the standards business and allow industry to run and maintain the system.
- Perhaps sending QARs to the same training used in industry is a good suggestion? The American Society for Quality has excellent training programs for auditors and technicians that would benefit the QARs.
- I think that DoD should have their auditors trained by RAB certified trainers (just like most of the industry does), and not receive their training from Government sources.
- It seems to me DCMA is pushing away from the hardware and product audit and focusing more on the systems approach. DCMA should stay away from this when ISO has registered an organization since ISO looks at the quality or management system overall. DCMA should remain focused on the hardware and products. DCMA is the representative of the military customer and user and should focus on the product.
- DCMA focus should be the procurement and risk management of the contract. DCMA is a tool for the Government to use to control the risk went the Government buys something. The question is how does the Government want to use DCMA. ISO as a tool determines if an organization has the capability from a systems point of view. DCMA primarily inspects hardware once the order is in and not a very good tool to determine the future risk of the supplier. DCMA seems more effective after the market research is conducted and a supplier is selected. DCMA uses in process and final inspection to compare the product against specifications. This type of inspection is better on tank tread than on a

missile guidance system. How to use DCMA depends on the product and how best to mitigate risk.

- Continue ISO and current industry quality assurance training. I see DCMA weakness is their inconsistent approach between the product quality and the quality of the entire organizations systems and processes. ISO looks at a whole product line. DCMA must take a more process oriented view because all our process are finally linked to the product. DoD organizations could become Third-party ISO registered

17. Question 17. (DoD and Contractor Quality Assurance Relationship)

How is the cost associated with becoming ISO 9000 certified applied to industry cost of doing business (CAS and GAAP)?

a. Discussion

Current CAS does not allow industry to directly charge ISO QMS application to its contracts. The question was asked to garner responses of how does industry apply the ISO Registration and QMS to that of doing business.

b. Responses

- From a business perspective one would be hard pressed to associate the initial outlays to the benefits over time, although estimates could be put together for ROI. Most businesses considering ISO certification are doing so because of a need expressed by their customers and certification is pursued to ensure that a competitive edge is maintained, or simply to maintain their current business. In many cases a business can find itself non-competitive in international or certain domestic markets if it does not have and maintain a certified quality system.
- The cost of registration is an overhead expense and is allocated across the entire business. (I am not familiar with CAS/GAAP)
- The fee for registration is a significant amount of money to give to the registrar. ISO cost is expensive and that expense is passed down, in one form or another, in overhead or what the customer pays. It goes to profit, an organization must cover their cost and it will end up somewhere in the profit line whether it is covered as overhead or as another cost.

C. DCMA INTERVIEW RESPONSES

1. Question 1 (ISO 9000:2000)

How is DCMA changing their approach to quality assurance and management certification and monitoring due to the changes in ISO 9000 1994 to 2000, as it applies to higher-level quality standards and risk management associated in this area?

a. Discussion

This question was designed for the respondents to provide insight to the reader on the changes DCMA is making in addressing ISO changes.

b. Responses

- The DCMA approach has not significantly changed. The 2000 ISO versions are seen and addressed as any other higher-level quality requirement. DCMA is currently reviewing its practice of issuing statements of qualification regarding supplier higher-level quality compliance with the intent of deleting the practice, however the determination is not based on the ISO change, but rather on the DOD practice of not requiring certified systems.
- DCMA Headquarters view is (ISO 9000) 2000 is not significantly different from (ISO 9000) 1994. The civilian sectors see this differently and are committing resources to make the change. DCMA should follow suite, at least partially, to assure our auditors are able to perform an audit at an appropriate level of knowledge and expertise.

2. Question 2 (ISO 9000:2000)

Have the problems, shortcomings, and lessons learned with the previous ISO 9000 standards and registration been addressed under ISO 9000:2000?

a. Discussion

This question was used to allow organizations to provide the researcher with insight into what DCMA quality assurance practitioners saw as the strengths, weaknesses, and opportunities of both ISO 9000:1994 and 2000 provide.

b. Responses

- Both respondents believed the new version addresses shortcomings with customer satisfaction and continual improvement but introduces new problems and concerns due to the cancellation of ISO 9002 and 9003 for industry, registers and compliance activities. DCMA plays a unique role

when addressing the shortcomings of any QMS. As the frontline worker they are enabled to address issues of this type. DCMA, as an in-plant representative, is the ombudsman for the Governments quality assurance and management program applied to procurement. As the frontline ombudsmen the DCMA representative protects Government interests in product assurance matching customer requirements with production challenges face by industry.

3. Question 3 (ISO 9000:2000)

Will their be any changes to the FAR, DoDD 5000, and to DCMA preaward surveys and surveillance? If so, can you provide an overview or any documents showing what these changes might be?

a. Discussion

The question was asked to update any recent changes to DoD guidance not covered under Chapter III.

b. Responses

- Unaware of any changes proposed solely due to the transition. A FAR change was contemplated to introduce ISO 9001-2000, however the current version of the FAR does not date versions so the 2000 version is already contained. A FAR change has been drafted that will include the designation of ANSI/ISO/ASQ Q9001 as a higher-level quality requirement. This change intended to assure that the accepted American version of ISO 9001 is included.
- We are currently working on an ISO 9000-2000 checklist in DCMA. Our checklist is nearly identical to most registrars except for about 10% to 20% of the document. In reviewing many registrars checklist we say that the majority of the documents was the same. The similarities are in the "shall" and "will" clauses of the registrars' checklists. The remainder of the registrars' checklist focused on their interpretation of the "may" and "should" clauses of ISO. The DCMA ISO 9000-2000 checklist is based solely on the "shall" and "will" clauses. DoD cannot contractually hold an organization to the "should" clauses unless they are specified outside the of the ISO 9000:2000 requirement.

4. Question 4 (ISO 9000:2000)

What planning, guidance, and training is DCMA conducting to address the ISO 9000:2000 changes?

a. Discussion

This question was used to ascertain the particular local and agency wide training on ISO 9000:2000.

b. Responses

- The change has been introduced to the workforce and the deltas between the 1994 and 2000 versions provided. Under a decentralized training environment, introductory training has been provided to a number of assigned personnel. Additionally, local organizations are encouraged to obtain more intensive training as required.
- Training is limited. Funding is limited to non-existent depending on the command. CMO's are told to fund training for ISO from their discretionary budget. The focus is on delta training to get the most effect for the limited resources for training. The training philosophy across DCMA organization to get our workforce knowledgeable on the 2000 version is "train the trainer." Many commands are sending one or two people to training and in-turn they are responsible for training the people in their local organization. There are some weaknesses in this approach but given the current resource constraint it is the current course of action.
- Under the MI-Q 9858 and 45208, each came with a handbook, H50 and H51 respectively, on how to properly use the standard. DCMA publishes no such handbook for ISO, nor does the IOS. IOS mandates what the standard is, not how to implement or evaluate.

5. Question 5 (ISO 9000:2000)

From your perspective what changes in ISO 9000 provide the greatest advantage and/or disadvantages to industry and the DoD procurement?

a. Discussion

This question was asked to establish DCMA respondents opinion on the advantages/disadvantages of ISO 9000:2000

b. Responses

Overall opinion was the introduction of exclusions to the requirements contained in clause 7 provides both the greatest advantages and disadvantages to both industry and the Government. The concept allows for the true commercialization of the QMS; however industry is responsible for truly understanding their markets and customers and

the DoD is now responsible for understanding the exclusions principles and determining if exclusions are appropriate, both in the pre and post contract award phases.

6. Question 6 (ISO 9000:2000)

How does or what role does customer satisfaction and contractor past performance play in DCMA quality assurance and management? What are its problems and how could it be made better?

a. Discussion

DCMA has the unique role of providing the most interfaces with industry as the DoD representative; this question was used to gain DCMAs perspective on that role as it pertains to customer satisfaction.

b. Responses

Customer satisfaction and supplier past performance serves a great role in DCMA QA activities. Risk management activities are extremely reliant on these factors. Problems revolve around communications and Government reluctance to export past performance information, at; I believe the insistence of industry.

7. Question 7 (ISO 9000:2000)

Should the redundancies between ISO 9000 registration and periodic review compared to DCMA preaward survey and surveillance be eliminated? Why or why not should Government evaluate the redundant areas?

a. Discussion

This question was posed to address one of the major problems associated between the DCMA, industry, and registrars of ISO. The questions goal was to bring into context the Third-party registrar and DCMA role in quality assurance audit and surveillance and provide DCMA responses to Industry Question Number 11.

b. Responses

Redundancies should be reduced; DCMA policy requires that first, second and/or third party audit results be assessed and used prior to performance of redundant activities. I do not believe that DCMA activities relative to suppliers QMS are redundant. A case

possibly can be made that preaward surveys regarding QA capabilities are not necessary for registered suppliers, but that registration should be reviewed in lieu.

8. Question 8 (ISO 9000:2000)

Has the SPI and the move to best commercial standards, like ISO, provided the DoD a better product and made the acquisition process better for customer, DoD manager, and industry?

a. Discussion

This question was used to gain the past experience of the DCMA interviewees and draw some conclusions about effectiveness of SPI.

b. Responses

- The SPI of only one standard to industry is deceiving. MIL-Q and MIL-I were not canceled. They are not the preferred method according to DoD policy. So when we (DoD) stopped dictating what quality system to use to allow the "most effective quality system" we opened the door for industry to choose the system. Many organizations decided to remain with the MIL-Q and MIL-I standards. DCMA now must not only understand ISO 9000:2000 but all of the previous Military standards still in use, many industry accepted quality standards like QS 9000 the automobile industry uses, as well as, ISO 9000:1994. The way the FAR is written we are discouraged to dictate to an organization any of these systems as long as they meet the "most effective" criteria. The challenge of understanding all of these systems, although there are many similarities between them, is difficult for DCMA to consistently and appropriately manage across the numerous sectors of business DoD is contracted with.
- Theoretically it makes the acquisition process better.
- DoD suppliers' complaint about the cost of having two or more systems prior to SPI is only a half-truth. Most organizations only used one system, MIL-Q, the cost of quality is something an organization will commit to even if it is not contractually outlined. The cost of implementing ISO, if they chose to leave MIL-Q, is only a 5% to 10% increase. The similarity between ISO 9000-1994 and MIL-Q 9858 were not significant enough, in my opinion, to warrant significantly more cost. Suppliers wanted DoD inspectors out of their factories and in SPI industry saw a way to accomplish the elimination of in-house DCMA representatives. Industry and NATOs push to use ISO instead of the Allied Quality Assurance Procedures (AQAPs) pushed DoD to make the change.

9. Question 9 (Quality System Versus Quality Product)

One criticism of ISO 9000 registration is it provides no guarantee of product quality or conformity, only that a quality process is in place. Do you agree, disagree with this statement?

a. Discussion

This question is based on the recent incidents of ISO 9000 registered organizations producing non-conforming and defective material. Its purpose was to elicit comments on some of the problems or misconceptions about ISO registration and what measures can be taken to increase quality control and product conformance.

b. Responses

- There are good registrars and poor ones. Some will register any organization given the right price. Most do not and do conduct a good quality system Third Party registration against ISO. What Third Party ISO registration does for us (DCMA) is to provide a certain level of confidence in the suppliers system we can use to assess the risk of the potential contract and make an evaluation on how to precede with the DCMA preaward survey. Registrars look at the quality system as a whole DoD should not only look at the total system but below that level as well. DCMA must inspect or provide insight into the product process quality. We track forward and back on product development.
- There are no absolute guarantees that either will result in a quality product. They should assist in identifying any system discrepancies that may lead to sub-standard product quality.

10. Question 10 (Quality System Versus Quality Product)

What quality assurance/management measures does DCMA take to insure a supplier demonstrates product conformity and/or critical characteristics, in terms of defect levels, are acceptable; and that improvements are planned and later demonstrated?

a. Discussion

The same question type was asked of industry to see what additional measures are used to provide product quality assurance.

b. Responses

DCMA employs a risk management philosophy of identifying key processes and their potential risks to performance, cost and schedule. Surveillance techniques, particularly regarding performance risk, include assessments of QMS, analysis of processes, audits of products and ongoing data analysis.

11. Question 11 (DoD and Contractor Quality Assurance Relationship)

Has ISO 9000 become the quality management standard for DoD contractors, i.e., must a contractor become ISO 9000 certified to conduct business with the DoD especially in contracts requiring a higher-level quality standard?

a. Discussion

The issue the researcher wanted to raise in this question is, although ISO is not mandated by any Federal procurement regulation and guidance, has ISO influence created an environment in which industry must be compliant with ISO to conduct business.

b. Responses

- Under A-76 the services have, in-essence, become responsible again for contract administration. Under an A-76 program the local procuring office administers the contract. Local procuring agencies use local policy. The policy is usually based on Army, Navy, or Air Force Regulation and Guidance, not ISO standards. An organization like DynaCorps Inc. who is ISO Third Party Registered and accepts an A-76 still has to be judged against the local policy for award and later for surveillance. Some local policy has adapted ISO. Service members and local contract officers have trained to conduct ISO Third-Party Registration. One example is DSC-Columbus. A-76 is another product of inconsistency of quality assurance and management across DoD faced by industry.

12. Question 12 (DoD and Contractor Quality Assurance Relationship)

Should DoD impose ISO 9000 standards and registration on contractors and sub-contractors as an entrance to conducting business with the DoD?

a. Discussion

This question was meant to elicit general comments on the benefits and problems of a DoD mandate of ISO 9000.

b. Responses

It was the opinion of the DCMA respondents that ISO should not be imposed. DCMA as well as industry believed that it will limit competition and may force out smaller entities. Further analysis is providing under Industry Question Number 10.

13. Question 13 (DoD and Contractor Quality Assurance Relationship)

Some DoD Quality Assurance Representatives (QARs) complain some ISO registered companies believe that if they are ISO registered that only limited DoD inspection is required. Should ISO registration be accepted by DoD QARs as certification for the Preaward Quality Assurance Survey and has registration reduced and/or eliminated DoD on-site quality inspections or audits during the surveillance phase, should it?

a. Discussion

This question was posed to address one of the major problems associated between the DCMA, industry, and registrars of ISO. The questions goal was to bring into context the Third-party registrar and DCMA role in quality assurance audit and surveillance.

b. Responses

- A case may be made to limit preaward surveys of companies that have certification; I believe more study is needed. I don't believe that ISO registration has been responsible for reduced QA activities. It's my opinion that QA activities on-site have been reduced due to personnel and money constraints forcing "smarter" decisions at both the pre and post award phases to concentrate activities based on risk.
- Earlier each service had their respective folks doing contract administration, i.e., AF PROS, and NAV PROS. We consolidated resources and became DCMC under DLA. We recently became our own agency and no longer fall under DLA. Our early auditors used the 8200.1 "Black Book." The "Black Book" spelled out how to conduct quality audits. The book used defined and express verbiage for many contracting scenarios and issues. We use product evaluations (PEs) and Product Verification Inspections (PVIs) in the conduct of contract administration. The 1990's saw the end of this type of inspection process and ushered in insight instead of inspection. The "One Book" replaced the "Black Book" and with it went specifics to generalists. DCMA went from a stovepipe

organization of the Quality Directorate, the Engineering Directorate, and the Contracting Directorate to a teaming approach. The approach does not work well and comes with its own set of problems. Under the stovepipe approach DCMA was able to mandate and control policy under each of the directorates. The team leader now controls the agenda of the team. The team leaders are not usually trained in all the functions so what directorate the team leader came from is the main agenda of the team with the other areas usually suffering due to the teaming approach. Under the new teaming system a great deal of latitude is given to each DCMA command and even office to define quality management and assurance according to current contract preaward surveys. The approach causes great inconsistency between how DCMA conducts audits and inspection, not only regionally but also within the same office.

14. Question 14 (DoD and Contractor Quality Assurance Relationship)

In your view has the DoD culture and approach changed in quality assurance audit procedures under accepting 'most effective quality system' instead of MIL-Q-STD 9858?

a. Discussion

The culture of DCMA from an employee's viewpoint is addressed in answering this question. The question was to gain perspective on an insiders' view of DCMA culture and attitudes effecting MIL-Q to ISO change.

b. Responses

- No, not particularly, due to the "most effective quality system" concept.
- In 1988 DoD wanted nothing to do with ISO. The culture, while slowly changing, still has yet to wholly embrace the SPI ideals around ISO. Culture is difficult to change. The aging of our workforce, the decline in our quality assurance workforce numbers from 24,000 in 1995 to 12,000 currently (numbers are approximate) and our inability to attract some of the best talent in the field of quality assurance and management are factors affecting the DCMA culture.

LIST OF REFERENCES

1. Anderson, S; Daly, D; Johnson, M. "Why Firms Seek ISO 9000 Certification," Production and Operations Management; Muncie; Spring 1999.

2. Beecham, B. "ISO 9001: 2000 and Smaller Companies." Management Consulting Brief.

3. Beckerdite, S. The Use of International Standards Organization ISO 9000 Quality Assurance Standards in place of Military Standards, Thesis B33535, June 1992, Naval Postgraduate School, Monterey, CA.

4. Chase, R. Operations Management for Competitive Advantage, McGraw-Hill Irwin, 9th Edition, 2000, Sections 2,3.

5. Clements, Richard B. Quality Mangers Complete Guide to ISO 9000, Prentice Hall, Englewood Cliffs, NJ, 1993, pp. 3-18, 46-55.

6. Commissionaries. "What is ISO 9000" www.commissionaries.bc.ca., pp. 1-4.

7. "Common to ISO 9000 and ISO 14000," The Magical Demystifying Tour of ISO 9000 and ISO 14000, www.iso.ch, January 2002.

8. Defense Acquisition Deskbook, ODUSD (AR) & OUSD (AT & L) AR & A Spring 2001 Version 3.5.
   -Federal Acquisition Regulation Part 46
   -Defense Federal Acquisition Regulation Part 246
   -Department of Defense Directive 5000.2R
   -DCMA Directive 1; Contract Management; "One Book"
   August 2001, Chapter 4,9.
   -OASIS Report 90404, DCAA. June 2000.

9. Desatnick, Robert L.; "Does QS9000 Really Protect the Customer," The Journal for Quality Participation; Cincinnati, OH; Spring 2001, pp. 46-48.

10. Deutch, J. SECDEF Memorandum of February 14,1994, Subject; "Use of Commercial Quality System Standards in the Department of Defense."

11. Dobbins, James H.; "Adequacy of ISO 9000 Certificates for DoD Weapon System Software Development Contracts," Program Manger, March-April 1996, pp. 42-51.

12. "DoD Regulatory Cost Premium Working Group Report"; Acquisition Reform Senior Steering Group, Compendium of Office Primary Responsibility (OPR) Office of the USD (A&T) Report 30. June 1995.

13. Dobler, D. Burt, D. Purchasing and Supply Management, Sixth Edition, McGraw-Hill, Inc.; 1996, Chapters 9, 21.

14. Drickhamer, D; "Standards Shake Up, " Industry Week; Cleveland, March 5, 2001, pp. 37-40.

15. Evans, James R.; Lindsay, William M.; The Management and Control of Quality; 4th Edition, South-Western Publishing, Cincinnati, OH, 1999, pp. 2-21.

16. Gaal, Arpard; ISO 9000:2000 for Small Business: Implementing Process-Approach Quality Management; St. Lucie Press, Boca Raton, FL; 2001.

17. Gansler, J. USD (A&T) Memorandum of September 18, 1997, subject: "Requiring Processes on Contract."

18. "General Guidance -- Quality Management Systems" Quality, www.acq.osd.mil.

19. Geoffery, Russell, Contract Integrity Center, DCMA, DCMA Overview Briefing.

20. "Global SPI Issues for SPI EC Discussion," Global SPI Issue Conference, December 8, 2000; SPI, www.dcma.mil.

21. Goodman, D. "Europe is Bad; Really, Really Bad, " World Trade; Troy, April 2001, pp. 14-15.

22 "Guidance for DCMA QARs," Quality Assurance and ISO 9000, www.dcma.mil.

23. Hutchinson, M. Harris, G., "The Single Process Initiative, " Arm AL & T, July-August 2000, pp. 28-30.

24. Information Memorandum No. 01-142 Memorandum For Commanders DCMDs, DCMA CMOs Subject: ISO 9001:2000, Quality Management Systems - Requirements (INFORMATION), www.dcma.mil, February 13, 2001.

25. "ISO 9000:2000 Selection and Use," ISO 9000, www.iso.ch, January 2002.

26. ISO 9001 Quality Management Systems-Requirements, 3rd Edition, Switzerland, December 15, 2000.

27. ISO 9004 Quality Management Systems-Guidelines for Performance Improvements, Switzerland, December 15, 2000.

28. Juran, Joseph M., Godfrey, A. Blankton; Juran's Quality Handbook, 5th Edition, McGraw-Hill, New York, 1999, pp .

29. Kaminski, P. USD (A&T) Memorandum of December 8, 1995, subject: "Single Process Initiative."

30. Kanholm, Jack; ISO 9000:2000 New Requirements, 3rd Edition, AQA Co. Pasadena, CA; 2000; pp. 17-32.

31. Levinson, William A.; ISO 9000 at the Front Line, ASQ Quality Press, Milwaukee, WI, 2000, pp. 1-5,17-20, 79-83.

32. Magnan, Dennis; "Defense Contract Management Agency-East, The Requirements of ISO/ASQ 9000 and ANSI Quality System Standards," Briefing to DCMA-West, 23-24 January 2002.

33. Magnan, Dennis; "The ISO 9000 Series Standard, The Year 2000 Revision," Briefing to DCMA-West, 23-24 January 2002.

34. Magnan, Dennis; "The ISO 9000 Series Standard, Executive Brief," Briefing to DCMA-HQ, June 1, 2001.

35. McGovern, Jack. Brokaw, N. "How Can DoD Benefit from the New ISO 9000?" Program Manager, January-February 2001, pp. 67-69.

36. McGovern, Jack. "ISO 9000-A Basic Quality System" Defense Systems Management College Manufacturing Management Department, Teaching, Note November 1999, pp. 1-5.

37. McGovern, John. "ISO 9000 Adopted for New Programs Contracts," Program Manager May – June 1994, pp. 21-23.

38. MIL-HDBK-50, "Quality and Reliability Assurance Handbook H50 Evaluation of a Contractor's Quality Program."

39. MIL-HDBK-51, "Quality and Reliability Assurance Handbook H51 Evaluation of a Contractor's Inspection System."

40. MIL-I 45208, "Inspection System Requirements," February 26, 1960, with July 24, 1981 update.

41. Nutt, James; Backoff, C.; "Why Strategic Management is Different," Strategic Management, McGraw-Hill, Inc., 1990, Chapter 2.

42. MIL-Q 9858, "Quality Program Requirements" December 16, 1963, with March 8, 1985 update.

43. Oliver, D. DUSD (AT & L) Memorandum Dated March 19 2001; subject: "ISO 9001:2000 Quality Management Systems – Requirements, Transitions."

44. Perry, W. SECDEF Memorandum of June 29, 1994, Subject; "Specifications and Standards – A New Way of Doing Business."

45. Perry, W. SECDEF Memorandum of May 10, 1995, subject; "Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition."

46. Perry, W. SECDEF Memorandum of December 6, 1995, subject; "Common Systems/ISO-9000/Expedited Block Changes."

47. Profile of ISO:9000, Allyn and Bacon Publishers of Simon and Schuster, Inc.; Bureau of Business Practice; Waterford, CT 1993, pp. 7-23, 107-117

48. "Quality Management Principles," ISO 9000, www.iso.ch, January 2002.

49. Roberts, Nancy C., "Four Approaches to Public Sector Management," Organizational Configurations, Chapter 12, p. 219.

50. Schaeffer, Mark; Deputy Director, Systems Engineering, DTSE&E/DDSE; Conference on Quality in the Space & Defense Industries; Cape Canaveral, Florida, March 1, 1999.

51. Sherman, S. Government Procurement Management , Special Edition 1999, Woodcrafters Publications, Germantown, Maryland, Appendix 4.

52. "Specific to ISO 9000," The Magical Demystifying Tour of ISO 9000 and ISO 14000, www.iso.ch, January 2002.

53. Stoddard, C. W. ISO 9000: Effect on the global Marketplace and Contract Relations with the US Department of Defe nse, Thesis S7336, December 1998, Naval Postgraduate School, Monterey, CA.

54. "Supplier Quality Assurance Self Group Briefing," Prepared by DCMC-OB, September 30,1999(Rev A).

55. "Transition to the ISO 9000:2000 Series," The Magical Demystifying Tour of ISO 9000 and ISO 14000, www.iso.ch, January 2002.

56. Womack, J. Jones, D. Lean Thinking, Simon & Schuster Inc. 1998, pp. 1-27,86-121.

57. Young, Mark, "Supplier Quality Assurance Revision": September 1999 Supplement to DCMA One Book, One Book, www.dcma.mil.

58. Zuckerman, A. "ISO 9000: 2000 Now Official, World Trade; Troy: Apr 2001 pp. 68-69.

59. Various Industry and Government Interviews; Quality Assurance Managers, Directors, and Auditors, November 2001-January 2002.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California

3. Dr. David Lamm
   Naval Postgraduate School
   Monterey, California

4. Prof. Michael Boudreau
   Naval Postgraduate School
   Monterey, California

5. Dr. Ira Lewis
   Naval Postgraduate School
   Monterey, California

6. Tommie J. Lucius
   Fayetteville, Arkansas